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ON THE COVER: This scale special issue is packed with realistic planes and accessories. Clockwise from top: Warbird Pilots jet aircraft figures; Evolution 77cc 7-cylinder engine; Warbird Pilots WW II Japanese pilot; Falcon Propellers Civilian prop; Robart Mfg.'s scale wheels and tires.

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Preflight

BY GERRY YARRISH | SENIOR TECHNICAL EDITOR



The NASA Scale Qualifier is a promising new scale RC competition in its second year. Attending scale competitions and encouraging new modelers to get involved is a great way to pump new blood into our hobby.

Special Scale Theme Issue

With the publishing year drawing to a close, we are again publishing our December issue with a nice helping of scale RC modeling added for your enjoyment. This scale theme issue remains one of our most popular issues, and it is a lot of fun to put the issue together. I've been a scale RC modeler for more years than I care to admit, but one thing is for sure: The hobby of building and flying scale replicas of full-size aircraft is rewarding. Besides the actual excitement and satisfaction of producing a scale model, you are also exposed to aviation history while researching your project. Add to this all the friends and flying buddies you make along the way, and you have the makings for a lifelong pursuit that just never gets old. Why fly a sport model when you can fly a fighter, bomber, transport, cargo airplane, or anything else that strikes your fancy? You get the idea—it's the difference between just a hobby and an adventure.

Another good thing all of us can do to help scale modeling continue to grow (besides building a scale model from a wood kit) is to get involved with local and regional scale events. Back in the day, there were literally dozens of regional and national level competitions, but today, they're few and far between. I recently attended a new scale competition in its second year. Hosted by the Black Dirt Squadron in Goshen, New York, this promising scale competition was conceived of and is managed by past WRAM (Westchester Radio Aero Modelers) show "spark plug" Danny Carozza. Intended to bring scale competition back to the Northeast, the NASA Scale Qualifier also includes fun scale to attract newcomers to the hobby. With a beautiful flying field and plenty of local, reasonably priced hotel rooms nearby, I encourage everyone to work this event into their schedule. If you can't make it to Danny's event, then check out the event calendar for your area. But get involved. Enter as a competitor or by volunteering to help the host club. We will all benefit.

In This Issue

We have a great lineup of scale articles, including some of our editors' favorite picks for scale airplanes and accessories. "The Right Stuff" guide has 39 great products, many of which are must-haves for modelers building scale RC aircraft. From covering and painting supplies to wheels, dummy engines, and specialty hinges, you'll find lots to add to your scale "lust list." Add to this some of our favorite scale RC airplanes and you have a big helping of scale eye candy.

We also have a primer for the proper installation of scale pilot figures by the man behind Warbird Pilots, Adam Martin. A longtime RC scale modeler, Adam started his company because he was disappointed with the pilot figures that were available at the time. His "Scale Pilot Figures 101" article is full of helpful hints to make your airplane look right. To improve your scale aircraft chances in competition, how about installing and detailing a classy scale cockpit interior? Well-known scale modeler Lyle Vasser explains how he fills in the scale pilot's front office. Lyle applies his amazing pilot painting skills from Best Pilots and shows how to improve any model's interior real estate.

All this and a lot more make our December issue extra special.

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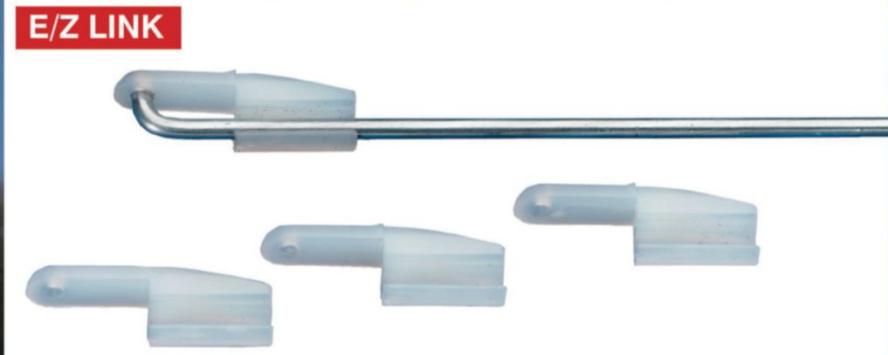
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We love hearing from our readers: Your emails, tweets, and comments quickly let us know what you'd like to see more (or less!) of in upcoming issues and online. Here's what some of you are saying about Model Airplane News magazine.



Facebook Sharing Photos

Since we started our Photo of the Week posts, we keep getting great comments from all of you. We look at past articles and try to find various images that show the wide scope of model airplanes that show up to fly. This great sunlit image of a 1/4-scale Curtiss JN-4 Jenny was snapped by David Hard at last year's Blue Max WW I event, hosted by the Sanford Aero Modelers RC club in Sanford, Florida. Built by Keith Goff, the Jenny earned the Outstanding Flight award for the scratch-built class.



RN: Thank you all. MAN does it well. You all make our flying models look great and realistic.



DH: Thanks for sharing.



HK: Awesome. That's what it's all about. Beautiful.



TBH: That is gorgeous.



CF: I thought it was real. Wow!



AM: Cool. I just saw a full-size Jenny at the Old Rhinebeck Aerodrome.

ModelAirplaneNews.com

The Super Bee!

In our November issue, we featured a construction article of Andy Clancy's newest Lazy Bee related design, the Bee Liner. In a sidebar story, we also showed a flight shot of the largest Lazy Bee ever built and flown: the Super Bee. We chatted with Mark Davidson, the original builder of this monster incarnation of the Lazy Bee. Mark built it in a team effort with beloved Joe Nall personality Kirby McKinney, and the plane first flew in 2009. With a 17-foot span, the Super Bee is powered by an Air Hobbies 9.8ci twin-cylinder engine and weighs 80 pounds. Mark renamed it the KirBee when his good friend passed away, and it is now hanging in the main hangar at the Triple Tree Aerodrome in Woodruff, South Carolina. (Photo courtesy of Laura McKinney)

Thomas Severence: I just read the article on the Bee Liner. I love all of Andy Clancy's designs.

Keith Holland: Wow. How long before someone builds an ultra-light man-carrying version? Crazy!

George Lewis: I have built a couple of Lazy Bees; the biggest had an 80-inch span! They all fly great.

Matt Wilson: I remember seeing the Super Bee at the Joe Nall fly-in! It's amazing. It flies just like the original model with three channels—no ailerons!

In Our Mailbox Fantasy Scale

OK, here's the deal. I am having an argument with a club member, and it has to do with scale documentation. My ill-informed buddy says that as long as you can find any type of documentation, your model can be built and considered scale. I am of the notion that the aircraft has to have actually existed and that you would also have to provide real photographs of your subject aircraft (not Photoshopped). What do you think? Please set my friend straight.—Charlie Thompson, Alexandria, Virginia

Hey, Charlie, this is a great topic of discussion. Many years ago, MAN contributor, aviation historian, and illustrator Jim Newman coined the phrase "fantasy scale" in an article of the same name. In it, Jim proposed a competition where model builders would design their own scale-looking but totally fake aircraft to help enliven RC model building in general. We see it quite often when someone shows up at an event with, for example, a WWII German wonder weapon that was, in fact, designed by the Luftwaffe but never put into production before the end of the war. So having three-views and/or artist renderings is, indeed, enough to design and build a model and consider it scale. But if you were to enter it in a scale competition, you'd score very low because of the lack of other documentation showing the aircraft's details. I think, because of this, you would not be allowed to enter a scale competition. I'd like to invite other readers to check in and let us know what they think.—GY



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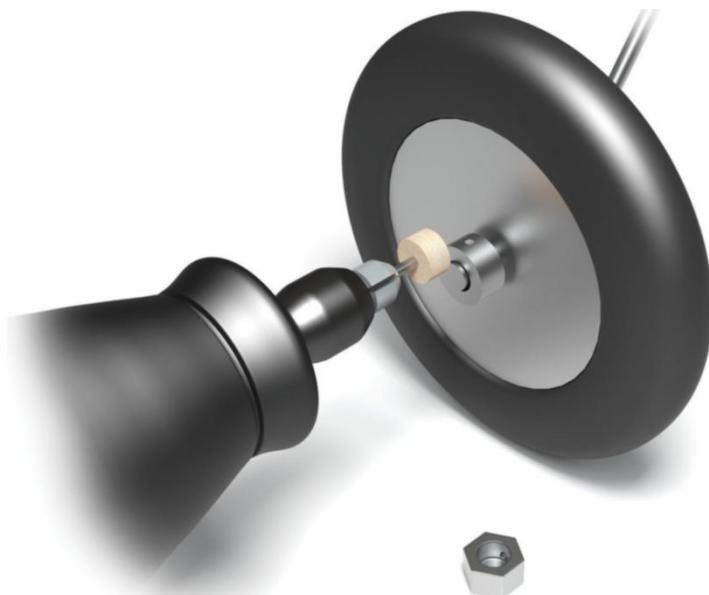
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Tips & Tricks

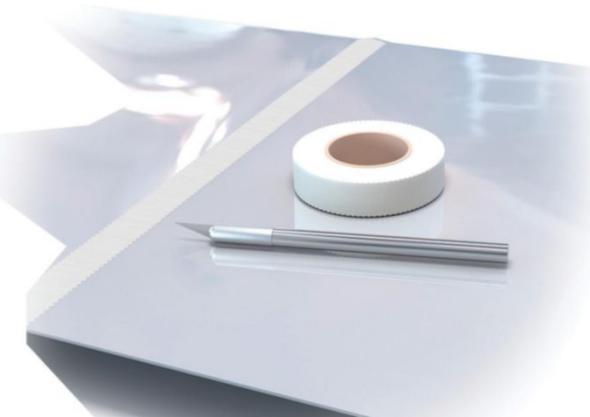
USEFUL HINTS FROM MODELERS | Illustrations by Richard Thompson



HEX COLLARS

To add a little extra scale appearance to my models, I take the regular wheel collars that hold my wheels in place on the axles and grind them with my Moto-Tool so that they look like hex-shaped nuts, similar to the castle nuts used on full-size airplanes. Be sure to hold the collar securely when you grind it.

Mike Gray, Seattle, Washington



ATHLETIC RIB TAPE

Available almost everywhere, self-adhesive athletic cloth tape is great for making scale rib tapes for fabric-covered airplanes. It comes in various widths from 1/2 to 1 1/2 inches, and its edges are pinked. The tape is flexible and goes around curves and rounded edges easily. It will also go over simulated rib stitching so that it shows through. Just roll it out and press it into place. Be sure to use sealer over the tape to secure it before painting.

Mark Howard, Provincetown, Massachusetts



CAP WRAPS

For years, I have been using the tinned wire leads from electronic components like large capacitors as wrap wire for soldering together my model landing gear. I bought a box full of electronic parts at a tag sale for \$1, and I have enough components to solder a dozen landing gear. Because they're pretinned, the leads are easy to solder in place as long as you make sure to clean them and the landing gear with fine sandpaper and then use some solder flux.

Walter Roberts, Scottsdale, Arizona



MAGNETIC CLAMPING

Neodymium magnets can be used as clamping tools for gluing two sheets together when clothespins don't reach far enough. Available at home-improvement stores, these magnets are strong and inexpensive.

Levent Suberk, Osmangazi, Turkey



SEND IN YOUR IDEAS! We want your ideas for Tips & Tricks! This month's winners will receive a *Model Airplane News* baseball cap. Send a photo or rough sketch and a brief description to MAN@airage.com or *Model Airplane News*, c/o Air Age Media, 88 Danbury Rd., Wilton, CT 06897 USA.

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PILOT
PROJECT
OF THE
MONTH

Ultimate

Ted Foster, Salem, Oregon

Ted built this 63-inch-span model from Bowman RC Aircraft plans, and he powers the 28% biplane with an Evolution 33cc gas engine topped off with a Tru-Turn spinner. The model has homemade landing gear, and cabanes made out of recycled aluminum. The engine cowl, canopy, and wheel pants are from Fiberglass Specialties.

F6F Hellcat & F4U Corsair

Andrew Beylerian, Bangor, Maine

Both of these fighters sport custom-made decals that Andrew made with his USCutter vinyl cutter. Each model sports retracts and is powered by a Magnum .91 four-stroke turning a 14x6 prop and use a Spektrum radio system.



F4U Corsair

Vinicius Giovanetti, São Paulo, Brazil

Vinicius's friend Elcio Schuermann assembled and detailed a giant-scale Top Flite Giant Corsair ARF into this showstopper. Powered by a Valach 60cc, the model Corsair has enough rivets and scale details to turn heads at any flying field.

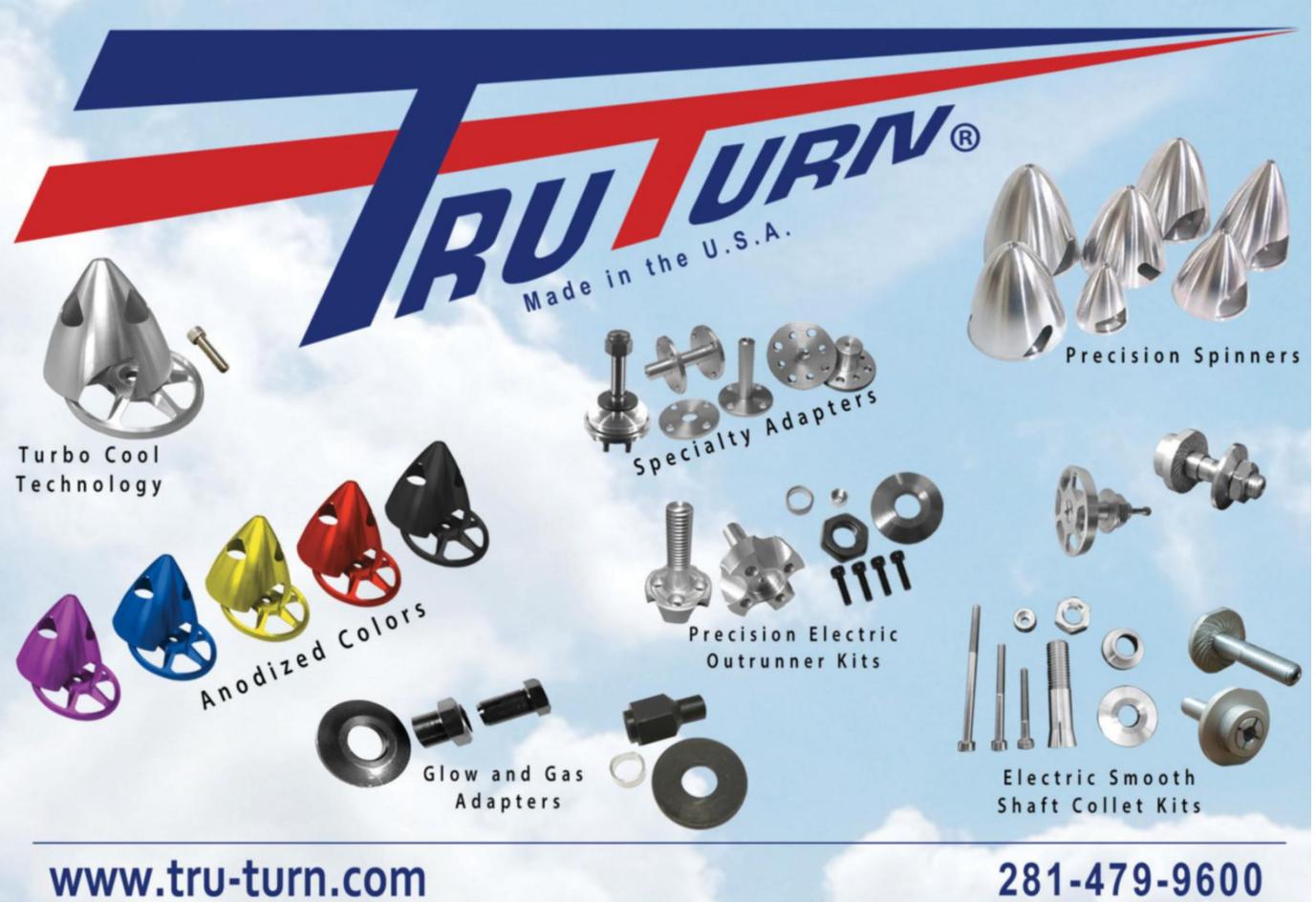


Sopwith Pup

Gord McTavish, Milton, Ontario, Canada

After building this WWI biplane from the Balsa USA kit and finishing it in the scheme of Richard King's Pup at the Old Rhinebeck Aerodrome, Gord hung a US 41cc gas engine on its nose. He notes that the model uses Hitec servos throughout and a Hitec Eclipse radio. We wish Gord smooth winds and soft landings on its first flight! \ddagger

SEND IN YOUR PICTURES! Model Airplane News is your magazine, and we encourage reader participation. Email your high-resolution images to MAN@airage.com, with your contact information and details on your project. Every pilot we feature will receive a *Model Airplane News* baseball cap, and the "Pilot Project of the Month" winner will receive a *Model Airplane News* "swag pack."



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Blade mCP S RTF

A one-box solution for those wanting a collective-pitch, flybarless, micro indoor powerhouse, the Blade mCP S is built upon the popular mCP X. With SAFE technology and AS3X, this heli makes learning on a collective-pitch heli a breeze. A low parts count makes repairs quick and easy, and the heli is powered by a 1S 210mAh battery, so there's plenty of punch in the brushed motor. Equipped with three different flight modes and a panic recovery, it's ideal for every intermediate pilot. Priced at \$169.99, the RTF version comes with a Spektrum MLP6 transmitter with AA batteries, two 210mAh 40C LiPo flight batteries with USB charger, and instructions. The BNF version is \$139.99.
horizonhobby.com



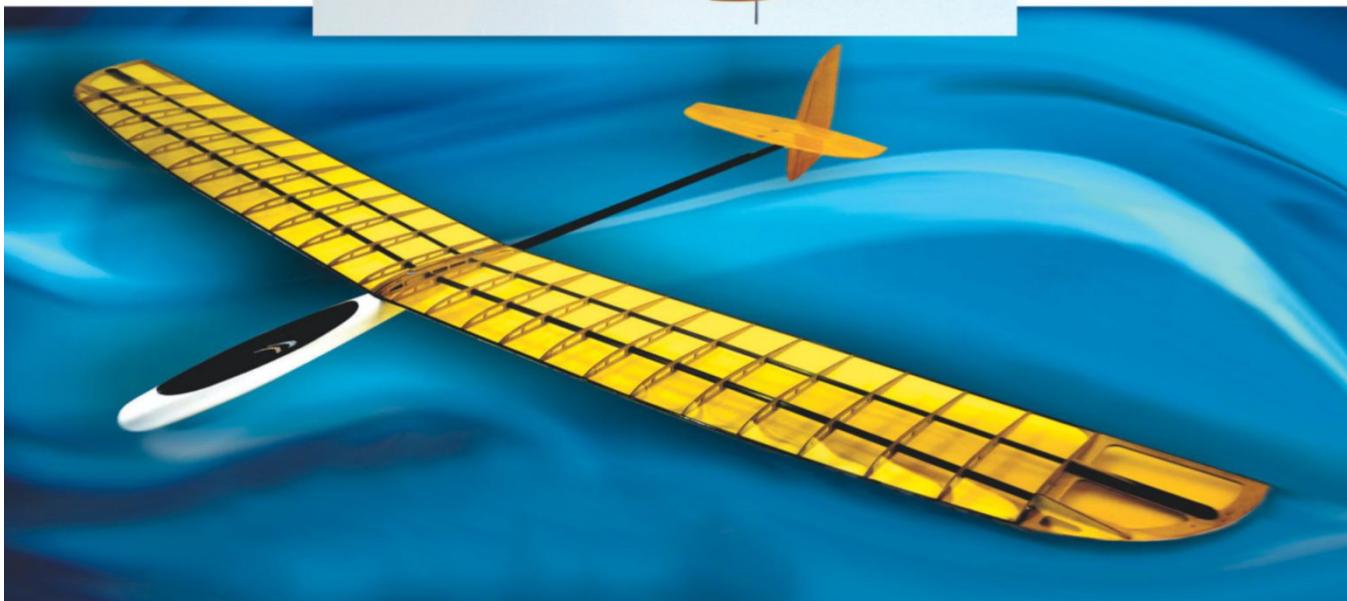
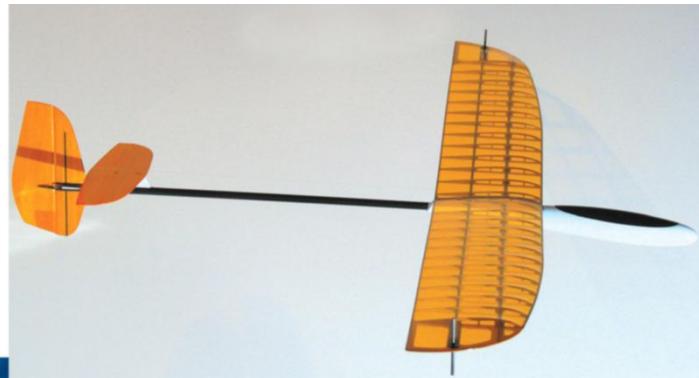
Multiplex EasyGlider 4

The new-generation EasyGlider 4 features the same easy-to-control flight performance and gentle characteristics as the original EasyGlider with several improvements. Molded out of resilient Elapor foam, the EasyGlider 4 has removable, lightweight wings, and the ultra-durable composite spar provides added strength. A new, more efficient ROXXY power system allows excellent climbs for gliding and basic aerobatics, and its detachable fin and tailplane make transport a breeze. Available in both a kit (\$104.99) and an RR version (\$199.99)—the RR model being equipped with servos, ESC, and brushless motor for immediate flying enjoyment. Classically designed, this robust electric glider is a must-have addition to your sporty, soaring collection.

weekenderwarehouse.com

Icare-Icarus Sailfish F3K 900

This high-performance micro 35.4-inch-span DLG has the same excellent flight characteristics of full-size 60-inch models in the F3K class and is ideal for beginner and intermediate pilots. A compact and easy-to-handle 2-channel design, the simple-to-assemble kit includes precision-cut aircraft-grade ply and balsa and carbon parts, fiberglass/carbon pod and boom fuselage, all the necessary hardware and control linkages, an assembly jig for the wing, glue for the assembly process, and iron-on covering material. Priced at \$119.00 for the kit, the Sailfish F3K 900 is also available as a receiver-ready DLG for \$299.00.
icare-icarus.com





Hitec X2 AC Plus Black Edition Charger/Discharger

The Hitec X2 AC Plus Black Edition AC/DC dual balance charger/discharger has a built-in 10-amp power supply. With increased capacity and compatibility, this portable, compact charging unit allows flexible charging of all battery chemistries at home or in the field. Its power-distribution mode allows you to assign the output power based on individual battery requirements, and the Voice Guide makes for easy, user-friendly communication. With its built-in power supply, internal balancing circuits and 10 charge/discharge profiles, the X2 AC Plus Black Edition is a powerhouse. Featuring "Scan to Go" and smartphone control via Bluetooth, this charger delivers high performance and convenience. The unit is priced at \$109.99.

hitecrcd.com



Blade 330X RTF

An all-in-one solution, the Blade 330X RTF is ideal for intermediate heli pilots looking to take on thrilling aerobatic maneuvers. Equipped with carbon-fiber blades, the 330X has clean and rigid flight performance. Priced at \$479.99, the 330X RTF comes with digital metal-gear servos for locked-in, predictable response. It also comes with a preprogrammed Spektrum DXe transmitter and AR636A receiver, and it's equipped with a Blade 440H 4200Kv brushless motor and a 45A ESC. Also included are a 3S 2200mAh battery, DC balancing charger, and instructions.

horizonhobby.com



Hangar 9 Valiant 10cc ARF

The new Hangar 9 Valiant 10cc airplane is every-

thing that made the larger version famous and is engineered to take advantage of smaller engines and brushless electric power systems. Like its big brother, the Valiant 10cc has a rock-solid feel in the air and is sure to become a favorite around your club field. Featuring lightweight, laser-cut balsa and plywood parts, this 69-inch-span ARF has a two-piece, cantilevered plug-in wing for fast field assembly. Its functional flaps expand its flight envelope and add STOL capability, while the wide-track aluminum landing gear provides outstanding ground handling. Also included are painted fiberglass cowl and wheel pants, clear canopy and side windows, and a complete hardware kit with a matching spinner. It costs \$249.99.

horizonhobby.com



E-flite Cirrus SR22T 1.5m BNF Basic

The E-flite Cirrus SR22T 1.5m park flier is an officially licensed replica inspired by the original, and it delivers rich details and a host of modern features that make it a thrill ride for most RC pilots. Part of the BNF (Bind-N-Fly) Basic series, this park flier comes with a AS3X receiver with optional SAFE Select Flight mode, a 10-size brushless outrunner motor, and a 40A brushless ESC and six Spektrum A330 micro 9g servos. Molded out of lightweight and durable EPO foam, the 60-inch-span SR22T comes with a hands-free wing servo connection system as well as cockpit detail with a pilot figure and tinted cabin windows, interior cabin and exterior navigation LED lighting, and two-piece plug-in wings and stabilizers. It requires a 3S 2200-3000mAh 11.1V LiPo flight battery and a Spektrum 6-channel DSM2/DSMX transmitter. The BNF costs \$229.99, and the PNP (Plug-N-Play) goes for \$199.99.

horizonhobby.com

E-flite PT-17 1.1m BNF Basic

The new E-flite PT-17 1.1m has everything you could ask for in a classic biplane. Out of the box, you only need to fasten six screws to get this classic biplane ready for flight. The included power system features a 15-size brushless, 850Kv outrunner and a 40-amp ESC. Its impressive shock-absorbing aluminum-strut landing gear features concealed spring-steel wire and large-scale wheels for great ground handling over grass. Priced at \$229.99, the PT-17 also comes with four Spektrum micro A330 9g servos, a Spektrum AR636A receiver with AS3X and SAFE technologies, and instructions. You supply a 5-channel DSMX/DSM2 transmitter and a 3S 2200mAh 25C LiPo flight battery.

horizonhobby.com



Hitec D-Series Servos

Hitec's new D-Series servo line has two new additions: the Sport Class D625MW and D645MW. Replacing the HS-5625MG and HS-5665MH servos, the D625MW delivers ultra high speed, while the D645MW is the upgraded super-torque version of the HS-5645MG and HS-5685MH. Fully programmable, they feature rapid, high-response, and high-resolution circuitry; possess smart-sense technology; and have wide voltage capabilities. Priced at \$39.99, both the D625MW and D645MW feature three durable metal gears with a metal/plastic first gear for the most efficient and reliable hobby-grade performance.

hitecrcd.com

Thunder Power RC 100C FPV Battery

Intended for FPV racing drones and other RC vehicles where high current demands are desired, the new TP1300-4SA100X battery is completely redesigned. The new 1300mAh pack has improved chemistry and wider relocated tabs, so the battery pack can pull amps more efficiently while reducing the battery's core temperature. It costs \$34.99.

thunderpowerrc.com

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Mike Goes Flying Magnum Engines

The popular line of Magnum engines is again available to modelers in the United States. Everyone knows Mike Greenshields, who has been involved with the RC hobby and with Magnum engines for years. Mike has now made distributing the Magnum engine line a family affair. Mike and John Greenshields have formed a new company, Mike Goes Flying, to again offer the top-quality engine line, which will include the .15, .25, and .52 two-stroke engines as well as the four-stroke .52, .91, and 1.60 flat twin engines. Prices for the two-stroke engines range in price from \$54.99 to \$79.99, and the four-stroke engines are \$154.99 to \$489.99.

mikegoesflying.com



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Freewing Model F-16 V2 6S Pro

One very cool aggressor electric jet

BY RICK BELL PHOTOS BY GERRY YARRISH



The subject of this review has a stunning Arctic camo scheme that gives the model an ominous appearance and makes it look very aggressive. Made out of molded EPO foam, the F-16 is available in three versions: 4S Standard, 6S Professional, and ARF Plus, which allows you to use your own power system. The 6S Pro version, which is also the subject of this review, is capable of speeds near 100mph right out of the box, powered by the included 70mm 12-blade fan and a 6S LiPo battery.

AT A GLANCE	
	MODEL F-16 V2 6S Pro Arctic Camo
	MANUFACTURER Freewing Model
	DISTRIBUTOR Motion RC (motionrc.com)
	WINGSPAN 34.5 in.
	PILOT SKILL LEVEL Intermediate
	ASSEMBLY TIME Less than 1 hour
	RADIO REQ'D 6-channel
	POWER REQ'D 6S 4000-5000mAh LiPo
	PRICE \$229.00
WHAT WE LIKE	
	Easy, fast assembly
	Awesome Arctic camo scheme
	Powerful 12-blade fan produces a nice jet sound
	Easy-to-fly fighter that's fast

UNIQUE FEATURES

When I saw some pictures of Freewing's Arctic camo version of the F-16, I thought, "Finally someone is doing something different other than an overall gray trim scheme." The black and gray colors are painted on, while the white is the natural color of the foam. I was impressed with the fit and finish of the jet and the overall smoothness of the foam. Most of the decals are factory applied, and a decal sheet is provided to customize your jet. Being a plug-and-play model, the servos, 80-amp speed control, 12-blade power system, and electric retracts are all factory installed, making for minimal final assembly. You only





FREEWING'S F-16 V2 6S PRO ARCTIC CAMO IS AN AWESOME JET! EASY TO ASSEMBLE AND EASY TO FLY, IT'S MY GO-TO JET WHEN I WANT SOME EDF ACTION. WITH ITS ARCTIC CAMO TRIM SCHEME, IT'S EASY TO SEE, AND FAST AND LOW PASSES DOWN THE RUNWAY ARE JUST TOO MUCH FUN.



A nice feature of the F-16 is the magnetically attached nose cone, allowing easier transportation and storage.



The cockpit doubles as the battery hatch for easy battery access. The pilot and an instrument panel come installed.



The powerful 12-blade fan is powered by a brushless motor and a 6S LiPo pack.



The electric retracts come factory installed and have worked flawlessly.

need to supply a transmitter, full-range receiver, and 6S LiPo to complete the model. All the control surfaces are hinged, and the removable wing panels must be slid onto a carbon-fiber tube and then secured with two screws per wing panel. I like that the nose cone is held in place with strong magnets as this makes for a more compact fuselage length for transport and storage. The horizontal stab and vertical fin are glued into place using the supplied contact cement. Each stab half has a slot in it for a carbon-fiber strip to reinforce them; I used ZAP thin CA for this. The removable canopy has a pilot and other details installed, and uses a tongue at the front and a spring-loaded

latch at the rear for easy battery and receiver access. One thing I really like is the blue control board for all the servo connections. This board eliminates Y harnesses: Each servo is plugged into its respective port on the board, then a single plug for each channel from the board plugs into your receiver—very simple and effective.

Assembly is pretty simple, and I didn't run into any issues. The first thing I did was to bind my Tactic receiver so that I could extend the landing gear and center the servo arms; after that, I followed the sequence in the user manual, which starts with installation of the wing panels. The horizontal stab halves were then glued into place along with the carbon-fiber reinforcements. When the glue had dried, I set up the ailerons and

elevator using the supplied pushrods and clevises as it was easier to do so without the vertical fin in place. Knowing that the model will be subjected to high speeds, Freewing wisely chose to stiffen the elevator pushrods with carbon-fiber sleeves—nice move! Another cool addition to the kit is a long piece of music wire with a hook formed on one end of it. Because the servo is installed in the vertical fin, its lead is very long and needs to be threaded through the rear of the fuselage up to the nose where the receiver is located. The music wire makes fishing the rudder servo lead a piece of cake. After the ventral fins were screwed onto their mounts on the bottom of the fuselage, the assembly was complete. I followed the manual for basic control settings, but I did use the Tactic radio's capabilities to set up dual rates for all controls. With that completed, the model was ready to balance. One thing that I would like to see added to the kit is the Sidewinder missiles that are on the wingtips of the full-scale jet as they are a distinctive feature; however, these, as well as other wing ordnance and spring-load landing gear, are available from Motion RC.

GEAR USED

RADIO

Tactic TTX850 w/ TR825
8-channel receiver (tacticrc.com); six 9g digital metal-gear servos [installed]

MOTOR

70mm 12-blade electric ducted fan, 2428-2300Kv outrunner, 80A speed control w/ 5-amp BEC (all installed)

BATTERY

Admiral Pro 6S 4000mAh 60C LiPo (motionrc.com)



The Admiral Pro 6S 4000mAh 60C LiPo battery is an excellent match for the F-16.

354th Aggressor Squadron

The F-16 Fighting Falcon has been around now for more than 40 years and continues to be the mainstay of many air forces around the world. One area of operation the F-16 excels at is the aggressor role, where the fighter is painted to resemble enemy aircraft for mock combat training missions to simulate dog-fights and other combat scenarios. Freewing's F-16 black, gray, and white camouflage scheme comes from the 354th Aggressor Squadron based at Eielson AFB, Alaska, and it is striking on the ground and even more so in the air.



IN THE AIR

We arrived at the field, and the weather couldn't have been more perfect for the first few flights with light breezes and comfortable temperatures. I belong to a club that has a small paved runway, so grass operations were not tested. The Admiral 6S 4000mAh LiPo battery is a perfect fit in the battery tray and can be positioned to achieve

the required center of gravity of 85mm. After some final checks, I performed a couple of fast taxi runs to see if any steering adjustments were needed, and none were. The F-16 accelerates quickly, but I let it build up speed before adding any up-elevator for a very positive takeoff. As the jet aggressively climbed to altitude, I needed to add a little aileron trim for straight and level flight. What was most impressive was that I immediately could tell that the fighter was going to be fast yet stable. I retracted the gear and made a couple of circuits around the field and then started making passes for the camera. As the jet flew around, you could see that Freewing did an outstanding job of capturing the sleek F-16 profile, and the Arctic camo scheme was just too cool! Landings are fun to do as the model will hold a nice high angle of attack all the way to the runway; you do, however, need to use throttle all the way to touchdown.



GENERAL FLIGHT PERFORMANCE

Stability: As expected, the F-16 has good stability and would make a good first jet for an intermediate pilot. The control response is good without being edgy, but a little expo really smooths out the flight. After a couple of flights, I moved the center of gravity back to 90mm and found that I like it better than the recommended 85mm.

Tracking: As you would expect from a jet, tracking is laser sharp! The F-16 is predictable and precise. It

doesn't get any better!

Aerobatics: The F-16 is capable of all jetlike maneuvers and then some. With the power it has on tap, long verticals are possible as are large loops that don't lose energy at the top. Rolls are quick, but I liked doing slow rolls the length of the field. With the center of gravity a little farther back, inverted flight was easier and required just a little push of the elevator for level flight.

Glide and stall performance: You'd never know this was a high-performance jet the way it glides! Being a slippery shape probably helps a lot here. Stalls are a non-event as it just drops its nose and slightly dips to the left. There aren't any flaps on the model, so landings are not "floaty," but the model does lock in on its glide slope and flare easily.

PILOT DEBRIEFING

It's very cool that Freewing has chosen to replicate such a neat aggressor trim scheme for its latest version of the F-16. The model not only has great performance but also looks awesome tearing around the sky! With its retracts, sleek shape, and powerful thrust, the F-16 is joy to pilot and pretend that you're flying combat missions!

BOTTOM LINE

Freewing's F-16 V2 6S Pro Arctic Camo is an awesome jet! Easy to assemble and easy to fly, it's my go-to jet when I want some EDF action. With its Arctic camo trim scheme, it's easy to see, and fast and low passes down the runway are just too much fun. If aerobatics are your thing, the F-16 won't disappoint with its agility. Because the wheels are on the small side, takeoffs are best achieved on a paved or hard-packed surface, but landing on grass isn't a problem. +

THE RIGHT

When it comes to scale RC modeling, many builders enjoy the fine busywork that's involved in turning just a nice scale airplane into a true work of art. Combining many smaller projects to produce an entirely finished scale project is very satisfying. It's the details that count, and whether you are building a model from scratch or just want to give your ARF a makeover, there are many accessories and products at your disposal to score a true scale touchdown. In this year's scale guide, we've included 39 of our top picks, along with some of our favorite scale planes. We're sure that you'll find a lot of cool scale stuff that's just right for you.



CARF-Models 1/4.5-Scale P-47 Razorback

This all-composite Thunderbolt CARF-Models plane was designed around the popular Moki 250 radial engine, and all the airframe parts fit beautifully together. It comes with the silver base surface and panel lines and rivets molded in, and the fuselage comes built with wing mounts and firewall installed. The engine cowl is mounted, and all provisions are completed to install the Moki engine. The rudder-servo mount, fuel-tank mount, and equipment tray are all built in or prepared to be bolted on. Canopy frames are also molded and reinforced with a 3D frame, which allows the optional scale sliding-canopy mechanism to be installed. A vacuum-formed cockpit kit is also included. The wing features a beautiful scale flap system with hinging, and the ailerons are also hinged in a scale manner. The wing is prefabricated to accept a specially designed scale landing gear with no modifications. With a wingspan of 110 inches, the finished Thunderbolt weighs 59.9 pounds and can also be powered by a 120cc to 150cc two-stroke gas engine. The price for the basic ARF airframe is \$3,790.00 (landing gear not included).

carf-models.com

STUFF

39 FAVORITE SCALE ACCESSORIES, PLANES, AND PRODUCTS

BY THE MOBIL AIRPLANE NEWS CREW

Nick Ziroli Plans Rotary Engines

For the WW I scale modeler, Nick Ziroli Plans offers dummy molded WW I rotary-engine kits. Ideal for many 1/3-scale airplanes, kits for the 9-cylinder Clerget 9B 130hp, 9-cylinder Oberursel UR2 110hp, and the LeRhone 9J 110hp rotary engines are available. Each kit comes with engine front, rockers, intake pipes, and cylinder heads. Molded out of white urethane plastic, these half-shell engines allow more room in the cowl for the RC engine. Prices for the rotary-engine kits range from \$45.00 to \$89.00, and they are also available completely built and painted (call for prices).

ziroligiantscaleplans.com



Strictly Scale Wheel Chocks

A hit on any RC flightline, Strictly Scale's wheel-chock sets cost \$40.00 each and start in a 3-inch-diameter size. They not only prevent your model from rolling around but also look scale to enhance your model's static appearance. The rigid and flat G10 base makes them

rugged, and the UV-resistant color finishes are fuel resistant. Unassembled kits as well as custom colors and lettering are also available.

strictyscale.com



SIG Mfg. WW II Bubble Canopies

The focal points that draw everyone's attention, cockpits and canopies are an important detail for any scale model. When it comes to bubble-top canopies, like those on the Grumman Bearcat, North American P-51, and the Douglas Skyraider, you need a quality molded canopy. SIG Mfg.'s sport scale II-style canopies are available in six sizes (5, 7, 9, 11, 13, and 15 inches long); the 5-, 7-, 9-, and 11-inch-long sizes are molded out of durable 0.030-inch-thick clear butyrate plastic, and the 13- and 15-inch-long sizes are formed out of 0.040-inch-thick material. Prices range from \$3.94 to \$13.51.

sigmfg.com

Du-Bro Products Cub-Style Wheels

Du-Bro Products' J-3 Cub-style wheels come in several sizes. Shown here are the "treaded" 1/4-scale, 4 1/2-inch J-3 Cub wheels, which have a foam interior with a lightweight yet rugged exterior. The standard axle (5/32-inch) hub can be drilled out for up to 1/4-inch axles. Sold in pairs with Cub hub caps, sizes include 1/5, 1/4, and 1/3 scale, and they cost from \$26.29 to \$33.99.

dubro.com



Balsa USA Lozengetex

Balsa USA's Lozengetex is Solartex fabric printed with the distinctive WW I German four-color lozenge pattern. This iron-on covering looks great and is easy to apply. The covering's adhesive has a wide temperature range, so it can be applied at low temperatures to mold easily around compound curves, and higher temps make removing wrinkles easy. Available in upper and lower surface colors, Lozengetex is available in 1/4- and 1/3-scale patterns. It comes in 26 1/4-inch-wide rolls in lengths of 96 inches (1/4 scale) and 127 inches (1/3 scale) and is priced at \$109.09 and \$144.31, respectively.

shop.balsausa.com

**Great Planes Pilot Busts**

The greatest crime any RC pilot can make is to fly a scale model airplane without a pilot in the cockpit. Don't be a scale law breaker—get a pilot bust from Great Planes. Available in several sizes and in civilian and WW I German styles, these pilot busts come painted or unpainted. These guys are available in several styles and sizes, including 1/7, 1/5, 1/4, and 1/3 scale, and they cost from \$9.99 to \$14.99.

greatplanes.com

Du-Bro Products 1/4-Scale Rod Ends and Turnbuckles

Designed for large-scale RC airplanes, Du-Bro's functional 1/4-scale turnbuckles feature right- and left-hand threaded end pieces and are adjustable in length by turning the center barrel. Packaged in pairs, just like the full-size rigging fittings, each has a hole drilled in the center for locking in the length setting with a safety-wire wrap. For fixed bracing and rigging wires as well as for upper and lower aileron connections, Du-Bro's 4-40 steel rod-end packs come with 12-inch-long 4-40 threaded rods, four steel attachment straps, and two threaded and two nonthreaded (soldered) rod-end fittings. Super strong, these hardware items are a must for all giant-scale RC planes. Prices are \$12.08 to \$11.58.

dubro.com

**Robart Mfg. 148E 90-Degree Rotating Retracts**

Specifically designed for 1/5-scale Curtiss P-40 Warhawks, Grumman Hellcats, F4U Corsairs, and Douglas Skyraiders, Robart Mfg.'s 148E 90-degree rotating retracts come ready to bolt into place. They come with a control unit that has three actuator circuits to operate the two main gear and a tailwheel. The control unit can be powered by plugging it directly into your receiver or with an auxiliary-drive battery pack. The 148E gear can operate with 4.8- to 9-volt input voltage, with maximum performance provided with 9 volts. DIP switches are used to adjust the functions of the control unit. Priced at \$495.95, the landing gear are constructed from aircraft steel and aluminum components, and feature functional 4130 chromoly steel Oleo struts and 1/4-inch axles.

robart.com

**Vogelsang Aeroscale Instrument Panels**

An excellent source for all things giant scale, Vogelsang Aeroscale offers many amazing scale accessories, including beautiful scale instrument panels. You can purchase them as kits or as complete made-to-order and ready-to-install units. Sizes range from 1/4 to 1/2 scale, and prices start at \$125.00, depending on the style and size.

vogelsang-aeroscale.com

www.ziroligiantscaleplans.com

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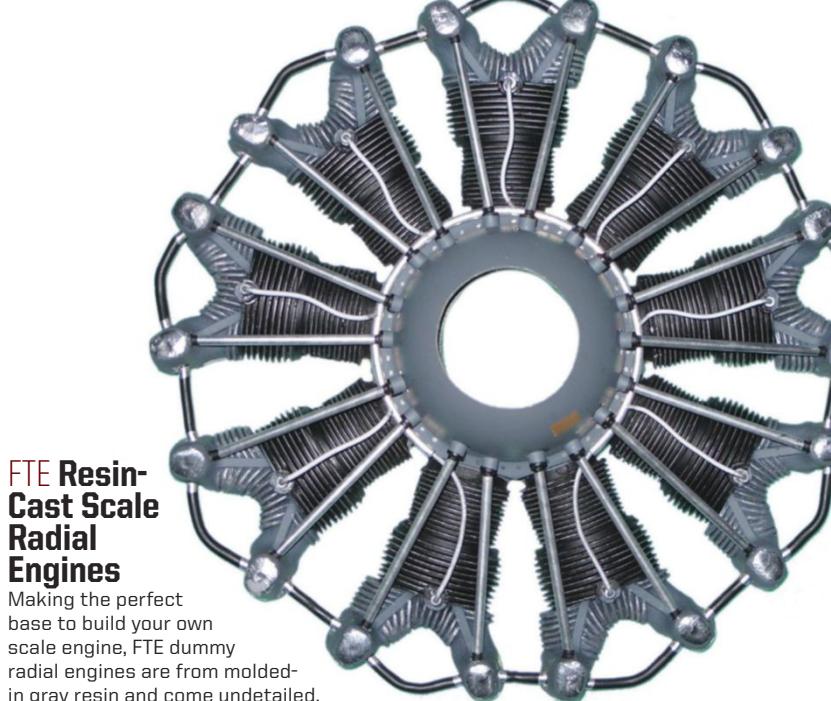
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Du-Bro Products Vintage Wheels

Ideal for WW I and other old-timer aircraft, rugged Du-Bro Vintage Wheels are molded out of durable and paintable ABS plastic and come with molded-in spoke details and smooth contour tires. Shown here are the 1/4-scale WW I 7-inch wheels, which are available in several popular sizes, including 1/8, 1/6, 1/5, 1/4, and 1/3 scale. Prices range from \$28.99 to \$81.99.

dubro.com



FTE Resin-Cast Scale Radial Engines

Making the perfect base to build your own scale engine, FTE dummy radial engines are from molded-in gray resin and come undetailed.

Available in several sizes, including 1/8-, 1/6-, 1/5-, 1/4- and 1/3-scale, their prices range from \$22.00 to \$98.00. Instructions on how to easily produce a gorgeous scale-looking engine are included.

franktiano.com

E-flite Servoless Payload Release

Bombs away! Installing a servoless bomb and/or payload drop is now super easy. Just install it in your wing or fuselage belly, and plug it into your receiver's auxiliary channel. The release comes with two matching attachment brackets that you attach to your scale droppable stores. The release pin is spring loaded, so you can attach your bomb without having to turn on your radio system. Several drop-sequence choices can be chosen with the press of a button, and multiple releases can be daisy-chained together to work with a single auxiliary switch. About the size of a medium-size servo, the release system is suited for all sizes of model airplanes. The price is \$24.99; extra attachment brackets are available separately.

horizonhobby.com



Top Flite Giant-Scale P-47 Razorback

Built for combat, this all-wood, giant-scale ARF WW II fighter features sturdy built-up and sheeted-wood construction and comes covered in MonoKote. The Thunderbolt has an 85-inch wingspan and is 75 inches long. The wing is designed for Robart retracts to easily bolt into place. The P-47 includes formed canopy, prop nut, wheels, molded radial engine, fiberglass cowl and wheel doors, dummy antenna, metal gun barrels, decal sheet, two aluminum stabilizer tubes, and instruction manual. Priced at \$749.99, the P-47 Razorback is ideal for a 50cc to 61cc gas engine or 80-85-160Kv outrunner brushless motor.

top-flite.com



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Motion RC Spitfire Mk IX 1600mm

This plug-and-play ARF has a 63-inch span and is equipped with a 5055-390Kv brushless outrunner motor, 80A speed control, and big 16x10 4-blade scale propeller. Intended for a 6S 4000-5000mAh LiPo battery, the Spitfire Mk IX is approximately 1/7 scale.

It comes with scale four-panel split flaps, LED wingtip lights and dorsal signal light, 17g digital hybrid servos, brass ball links, and nylon hinges on all control surfaces. It has removable wings, cannon, and antenna for easy transport, and two sets of decals are provided. The retractable landing gear with shock-absorbing struts has 5mm-thick steel pin and metal-trunnion construction, and is grass runway-capable. The price is \$349.00 (receiver and 6S LiPo not included).

motionrc.com/flightline



Best Pilots Custom Scale Figures

Well known for his highly detailed and historically accurate pilot figures, Lyle Vasser of Best Pilots produces hand-sculpted and molded figures approximately 1/5 scale in size. Each pilot is a reproduction of actual WW II pilots, including USMC "Pappy" Boyington, U.S. Army Air Corps; Bob Sweeney; RAF "Sailor" Malan; German ace Günther Rall; and Japanese ace Saburo Sakai. Vasser also offers a 1/4-scale WW I pilot Lothar von Richthofen and generic 1/8-scale bomber-crew figures. Prices range from \$65.00 (unpainted) to \$235.00 (painted) for 1/5 scale, and \$95.00 (unpainted) to \$235.00 (painted) for 1/4 scale. Also, Vasser's pilots can also be turned into personal versions of yourself. Using a 3D-printed face matched to photos that you provide, these amazing "Mini Me's" are truly the ultimate final touch for anyone's scale airplane (available painted and unpainted, call for pricing). bestpilots.typepad.com



Cal-Grafx RiveterPro

The new RiveterPro (\$29.95) makes applying evenly spaced, consistently sized, glue-droplet rivets easier than ever. It consists of prepunched masking strips and a bottle of Rivet Applicator fluid. Available in three sizes of rivet diameters and spacings, cured rivets have the best appearance after painting. The sampler kit includes a bottle of applicator fluid and a three-strip of each size. cal-grafx.com



Nick Ziroli Plans 3D-Printed WW I Machine Guns

What's a WW I fighter without gun? A target! Don't be a target; these impressive scale machine guns are available in five sizes (1/8, 1/6, 1/5, 1/4, and 1/3 scale). These German-made machine guns are 3D printed out of ABS plastic and come in easy-to-assemble kits. Variants of the models are available, including Vickers (\$8.00), German Spandau (\$12.00), and Lewis type-2 and type-3 (\$15.00). All come with instructions. ziroliantscaleplans.com



Freewing A-10 Warthog Super Scale 80mm

The mean-looking A-10 Warthog is a tough, ground-pounding attack aircraft loved by our troops and feared by the enemy. The Freewing A-10 is just as impressive as its full-size counterpart, and with a 67-inch span and powered by twin 80mm ducted fans, it has equally impressive flight performance. Molded-in, nicely detailed EPO foam, the A-10 has an accurate scale appearance and comes highly prefabricated. All wiring comes factory installed, and it has functional navigation, position, strobe, and landing lights. It also comes with a complement of external weapons and mounting pylons. Priced at \$599.00, the A-10 is a great plug-and-play jet that all jet jockeys would want to add to their RC hangar.

motionrc.com/freewing



Evolution 7-Cylinder 77cc Radial Glow Engine

With stunning looks and impressive sound, the Evolution 7-cylinder 77cc four-stroke radial glow engine delivers dependability and performance. Its cylinder head and crankcases are produced from aircraft-grade alloys. This functional piece of scale hardware features heavy-duty double-bearing crankshaft support, billet aluminum pistons, hardened steel rings, hard-chromed and lapped cylinder bores, hardened-steel cams, and a carburetor jet valve with a split opening for smooth acceleration. This radial engine uses zero percent or low nitro (5-10%) fuel, with low-oil content or only 5 to 7% oil/fuel ratio. Priced at \$1,299.99, this radial engine has a diameter of 9.1 inches and has an output rating of 4.8hp. An optional Evolution exhaust silencer ring is also available.

horizonhobby.com



Robart Mfg. Scale Wheels and Tires

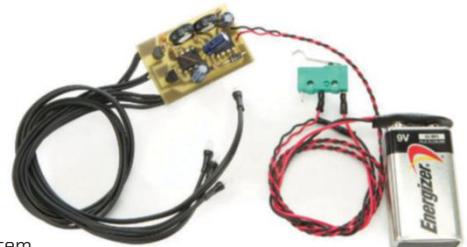
Every scale warbird needs good-looking landing gear, and the focal point for all gear are the wheels and tires. Available in many popular sizes and styles, you have a choice of molded plastic sport scale wheels or top-shelf CNC-machined aluminum wheels with scale "Firestone" tires complete with scale treads. When matched to the appropriate Robart retractable landing gear, the combination makes a big difference in how your plane looks and handles during landing. Prices range from \$14.45 to \$22.45 (plastic) and \$68.45 to \$79.95 (aluminum). Replacement tires also available.

robart.com

RAm Products

#186 Gun Flash Kit

If you want to really wake up your machine gun-equipped WW I airplanes, try this system of ultra-bright gun-flash lighting.



The system provides four flashing lights, with an adjustable flash rate and intermix powered by a 9-volt battery. Easily mounted in the machine-gun muzzles, they're controlled by a micro switch, which can be attached to the same servo that controls a RAm machine gun-sound generator (sold separately). Priced at \$29.95, the flash kit puts the fun in scale.

ramcandramtrack.com



Hangar 9 60cc Corsair

With a wingspan of 85 1/2 inches, this F4U-1D Corsair ARF is a truly impressive warbird. With superb flying characteristics and an accurate scale outline, the Corsair comes with a convenient three-piece wing assembly with an aluminum blade spar. Details include a Pitot tube, wing guns, and leading-edge stall-strip details, along with functional three-panel flaps that deploy using internal linkages. Optional Robart electric or pneumatic main and tail retracts, scale wheels, and a sliding clear canopy with painted frame and magnetic closure shields a full-depth detailed cockpit and instrument panel. The Corsair comes finished in UltraCote covering and with decals included for four different squadron markings. Priced at \$999.99, the Corsair is designed to fit a wide variety of two- and four-stroke engines. Optional 5-inch aluminum wheels are available with a matching white powder-coat finish.

horizonhobby.com



Nick Ziroli Plans Static Scale Propeller Kits

The classic Hamilton Standard 3- and 4-blade propellers were used on many fighter aircraft, and this kit from Nick Ziroli Plans is ideal for many round-nose warbirds like the F4U Corsair and Grumman Hellcat. A true eye-catcher, this static-display, nonflying propeller is just the ticket to maximize your static score at any RC scale meet. The kit comes with resin-cast propeller blades, several laser-cut plywood hub parts, a pitch gauge, and vacuum-formed front and back hub covers. The kit can be assembled with a few hand tools using the included parts. The price for the 3-blade kit is \$80.00, while the 4-blade kit is \$95.00.

ziroliantscaleplans.com



Arizona Model Aircrafters Spoked Wheel Kits

Spoked wheels are a big part of vintage airplanes, and if your plane needs open-spoked wheels, there are only a few sources. Arizona Model Aircrafters offers kits for the basic parts, which average modelers can easily produce themselves. These include a pair of machined (and drilled) aluminum rims, brass hub parts, brass rim inserts, tire material, and detailed instructions. You supply the spokes in the form of 1/32-inch music wire, available at most hobby shops. The instructions show how to make the plywood assembly and alignment jib and how to solder the spokes in place. Sizes range from 3 1/4 to 10 inches in diameter, and you can order standard 40-spoke or British 64-spoke patterns. Prices range from \$95.00 to \$195.00.

azmodelaircrafters.com



Balsa USA 1/4-Scale Deluxe Nicopress Starter Set

Many large 1/4- and 1/3-scale airplanes require functional rigging wires, so you have to install them correctly so that you don't suffer an in-flight failure of a wing panel or tail surface. The 1/4-scale Deluxe Nicopress Starter Set makes this daunting job much easier. Included in the package are the swage (crimping) tool, a multiple-size sleeve-width gauge, 36 oval copper sleeves, and 30 feet of 1/32-inch braided-steel cable. The instructions show the specifications for the proper crimps to use for each sleeve based on the cable size you use. Ideal for flying and landing wires as well as tail rigging and control-surface pull-pull cable systems, the Nicopress tool produces crimps that are both super strong and very scale in appearance. The included tool has jaws for 1/32-, 3/64-, and 1/16-inch cable sizes. The price of this handy kit is \$47.30.

shop.balsausa.com



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Warbird Pilots Jet and Prop Pilot Figures

For every scale cockpit, there is a suitable and proper scale pilot figure. If you are looking for poseable pilots with accurately sewn clothing and gear, Warbird Pilots is your one-stop shopping recruitment office. Available in several styles and scale sizes, pilot figures come in WW I, WW II, civilian, and modern jet and helicopter styles, each outfitted to fit your needs. Scale sizes include 1/6, 1/7, 1/8, 1/4, and 1/4.5 scale. WW I pilots are also available in 1/3.5 and 1/5 scale sizes. Pilot busts and custom servo-equipped pilots are also available. Prices range from \$69.99 to \$159.00; WW I 1/3- and 1/3.5-scale pilots are \$174.99.

warbirdpilots.com





FMS A6M5 Zero 1100mm

This 43-inch-span, plug-and-play WW II Zero fighter is highly maneuverable. Featuring electric retractable landing gear and landing-gear doors, drop tank, 3-blade scale propeller, and spinner, the Zero comes equipped with split flaps and a lot of scale details to add to its realism. Molded out of durable EPO foam, it has an easy-to-remove one-piece wing and full-length carbon-fiber wing reinforcement for durability. Priced at \$239.00, this Japanese fighter is enhanced with plastic molded details including engine cowl, air scoop and oil cooler, machine guns, strut covers, antenna mast, and Pitot tube.

fmsmodel.com

Fiberglass Specialties Cowls, Pants, and Canopies

The largest hobby supplier of molded epoxy-glass model-airplane parts and accessories, Fiberglass Specialties offers hundreds of products. All hand-laid to order, they are a perfect match for many ARFs, kits, and model-airplane

plan sets. Products include dummy engines; scale engine cowls; radial cowls (smooth and with blisters); wheel pants; and several clear, molded plastic canopies. Many parts are also available for *Model Airplane News* plans. The radial cowls are available in several generic sizes. A bonus is that you can request a photo of the product before you place your order. Prices range from \$21.00 to \$75.00.

fiberglassspecialtiesinc.com



Falcon Vintage, Military, and Civilian Props

Falcon propellers have just released a new scale series of propellers for that authentic look. Falcon offers an excellent selection of weathered vintage WW I props. The new civilian propellers are designed to replicate aluminum propellers. Also the Hamilton design has an aluminum finish with a scale hub, ideal for a Gee Bee racer or Texan. The WW II 2-blade props come with realistic scale decals, a black finish, and rounded yellow tips. The new WW II 3-blade propellers have the same realistic finish and rounded yellow tips. Produced from top-quality German beech wood, this new scale line will provide a great finishing touch to any civilian or warbird airplane. Sizes begin at 16x8 and up to 30x10, with new sizes arriving all the time. Prices start at \$18.50.

falconpropellers.com



Williams Brothers Model Products Giant-Scale Wheels

Big vintage planes need proper wheels and tires. These highly detailed 1/3-scale WW I wheels are based on original Fokker factory drawings for a 700x100 tire. The German wheels are 9.2 inches in diameter and available with gray or white tires (\$99.95/pair). Removable 3/8-inch-inside-diameter, Oilite, bronze, oil-impregnated axle bushings are also included.

wmbros.com



Strictly Scale 3D-Printed Accessories

One thing's for sure: You just can't have enough detail on a big turbine-powered jet. Designed for the ultimate in scale jet appearance, Strictly Scale's Exterior Surface detail packages are available for 1/6-scale F-16 Falcon as well as 1/7-scale F-18 Hornet and F-15 Eagle jets. Prices range from \$95.00 to \$145.00 and, depending on the type of jet, include a wide range of molded parts including AOA and air-data probes, IFF transponder antennae, and other antenna types.

strictlyscale.com



Top Flite Replica Radial Engine 1/7-Scale Kit

Patterned after the Pratt & Whitney radial engines that powered numerous aircraft from the "Golden Age" of aviation, this 1/7-scale dummy engine is modeled to fit the Top Flite F4U Corsair and AT-6 Texan and will fit any cowls with a frontal opening of 6 1/2 to 7 inches. Priced at \$10.99, the kit includes vacuum-formed white plastic sheet with dummy engine, three 8-inch pushrod tubes, 16-inch wire for ignition leads, and instruction sheet. [Other dummy engine kits also available.]

top-flite.com



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F&M Enterprises Poly-Tone Paint

F&M Enterprises has been in the aircraft finish business for more than 25 years and offers Scale Stits, an RC version of the Poly-Fiber covering material used on full-size aircraft. The company supplies all the covering materials, including Poly-Tak adhesive and polyvinyl Poly-Tone paints, sealers, undercoats, and reducers. The Scale Stits products all work together to create a strong mechanical and chemical bond between the cloth, sealer, undercoat, and finish paint layers. Poly-Tone paint is \$24.50 (per quart), and the reducer is \$15.40 (per quart). Call for pricing for other Poly-Tone products.

stits.com



Top Flite Cockpit Kits

The cockpit of any model airplane automatically draws the eye to see what's under the canopy. A great way to furnish the pilot's office is with these lightweight cockpit-detail kits. Shown here is the kit for the Top Flite giant-scale P-51 Mustang (\$26.99), and once installed, it adds much to the realism of any ARF or kit-built plane. Kits are available in several sizes (.60 size and 1/7, 1/8, and 1/5 scale) and for various Top Flite planes, including the Corsair, Spitfire, Thunderbolt, Zero, T-34 Mentor, Cessna 182, and Stinson ARFs. Prices range from \$13.99 to \$54.99.

top-flite.com

Sonic-Tronics Landing-Gear Door Hinges

It's said that there's a solution for every job, and when it comes to installing tight-fitting landing-gear doors, you'll want the hinges that will get the job done. Available in several styles, the door hinges from Sonic-Tronics are strong and injection-molded in exactly the correct shape to make flush-fitting doors operate smoothly without binding. Special injection-molded hinges are available in molded nylon hinges as well as carbon-fiber-filled designed hinges for use on flaps, spoilers, landing-gear doors, and many other unique applications where extra strength is wanted. The tricycle door kit (\$25.95) includes all the hinges, springs, and special items to create operating wheel doors on your aircraft. Prices range from \$1.35 to \$6.29, depending on the type and number of hinges.

sonictronics.com ↗

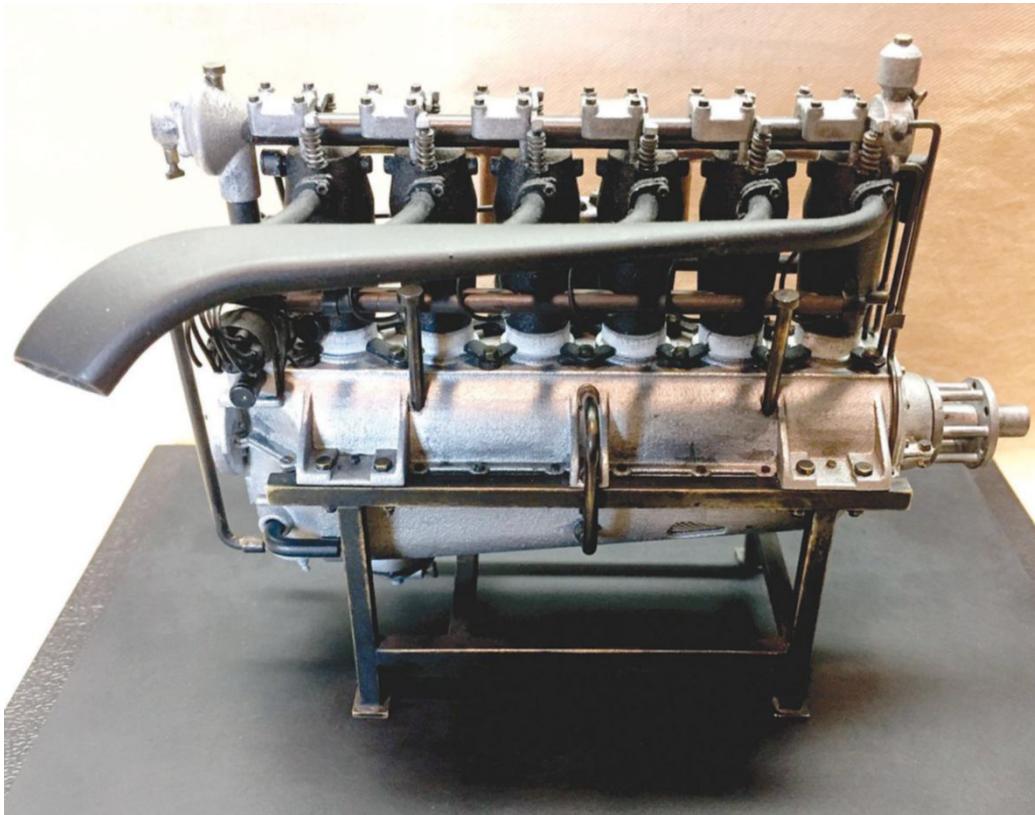


Williams Brothers Model Products Scale Wheels Williams Brothers

Model Products has been producing scale wheels for many years, and the line is extensive. The scale wheels are made with injection-molded ABS wheel hubs, with rubber-based tires. The styles include balloon, vintage, smooth-contour, and Golden Age wheels. Depending on the style, sizes range from 3/4 inch to 6 5/8 inches, with prices (per pair) from \$2.95 to \$44.95. The 2 1/2-inch and larger vintage wheels are stuffed with a long-lasting extruded foam rod for better support, and the hubs are now molded in a realistic linen color. The tire color is typically black, but some sizes have "white tyres" available, as commonly found up to the early 1920s. The Golden Age, smooth-contour, and balloon wheels now have gray hubs instead of the original white.

wmbros.com





Arizona Model Aircrafters In-Line Mercedes Engine Kits

Intended for use in RC flying and static-display models, these kits are based on drawings from *Scale Aircraft Drawings: Vol. I* by Air Age Media. All laser-cut components are highlighted in blue on the drawings, and larger-scale kits have a combination of wood and fiberglass cylinders, making it easier to install your model's engine or motor inside the scale Mercedes. Kits are available in several sizes, including 1/12, 1/6, 1/4, and 1/3 scale, and prices range from \$65.00 to \$155.00. For anyone building a complete engine for an RC flying model, Arizona Model Aircrafters will cut custom plywood motor mounts for electric and gas engines for only the material cost; call for details.

arizonamodels.com

Jet Central Dual Sequencer

While flying large turbine-powered jets and other scale airplanes, the proper function of the retractable landing gear and their gear doors is very important. One way to simplify all the operation setup is to use sequencers. The new Dual Sequencer from Jet Central makes it easy, and it includes adjustments for programmable servo-door speed, two additional servo outputs, and five LED indicators for status, doors, gear, canopy, and pressure. The dual sequencer has a small compact aluminum case and also features an external programming platform. Other functions include delay between doors opening, selectable main door, a wrong position start-up, fail-safe and programmable pressure and voltage gear fail-safe, eight timers (five for gear and three for canopy), four-language setup (Spanish, English, French, and German), choice of four pressure units (bar, Kg/cm², KPas, and psi), and independent gear and canopy sequencing setup. It costs \$150.00.

jetcentral.com.mx



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Tower Hobbies P-51B Mustang “Berlin Express”

Full of features at a great price point

BY MIKE GANTT PHOTOS BY JOHN REID



Wanting to get in on some warplane sorties, I happened upon the Tower Hobbies P-51 series of Mustangs. There are currently four versions, and my eye was immediately drawn to the “Berlin Express” replica. The model is made out of molded AeroCell foam, which is durable and easy to repair if needed. Its simple assembly goes quickly and does not require adhesive; you’ll only need a Phillips screwdriver and an adjustable wrench. Included in the Rx-R (receiver-ready) box are the assorted required items to get flying minus a flight battery and guidance system. A low-cost 3-cell battery in the 1800–2200mAh range is ideal. If you decide to add any optional equipment, I suggest using a 6+ channel receiver for flexibility. Removable fixed landing gear come standard, but retractable gear can be added. Provisions for flaps are also included, but you will need to add two micro servos and a little glue to hold them in place. I found both the flap and retract add-ons for about \$40.00 on towerhobbies.com and think they’re worth the investment. Intermediate and advanced pilots are sure to have a great time with this World War II workhorse.



The extra-long hatch allows easy access to the electronics.



THE 40-INCH-SPAN FOAM “BERLIN EXPRESS” BEHAVES LIKE A FUN SPORT PLANE IN P-51 “CLOTHING” WITH A WELL-MATCHED POWER SETUP AND SPEEDY PERFORMANCE.

**AT A GLANCE**

MODEL
P-51 Mustang "Berlin Express"

MANUFACTURER
Tower Hobbies (towerhobbies.com)

WINGSPAN
40 in.

PILOT SKILL LEVEL
Intermediate

ASSEMBLY TIME
2 to 3 hours (including flaps & retracts)

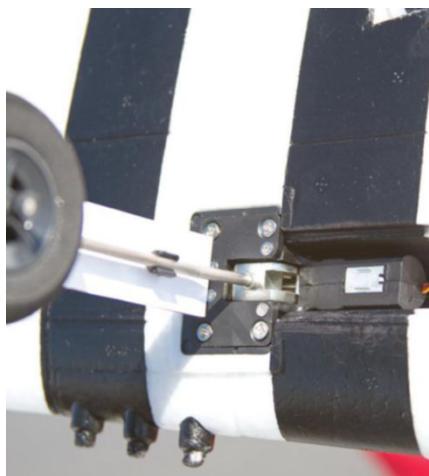
RADIO REQ'D
4+ channel (6+ channel with flaps & retracts)

POWER REQ'D
3S 2200mAh LiPo

PRICE
\$119.99 (\$144.77 with flaps & retracts)

WHAT WE LIKE

- + Minimal assembly and good part fit
- + Power system and servos preinstalled
- + Wide flight envelope; no bad habits
- + Great value



Adding the retractable landing gear is well worth the minimal investment.



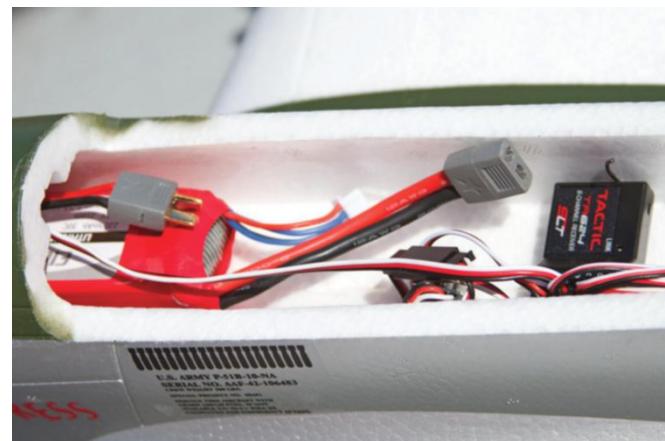
Simulated machine guns are factory fare. The gear covers help keep the airframe a bit cleaner in flight.



Setup for steering is made easy with the adjustable tailwheel.



Tested on a three-position switch, the plane exhibited no flight deviations with the flaps deployed.



There is plenty of room under that huge hatch. Test flights were conducted with the center of gravity in the middle of the recommended range.

UNIQUE FEATURES

Combinations are available, so if you want just the plane or the plane with extras you can save a few dollars; I'm thinking everyone will like that. The flaps and retracts each require a Y-harness. Fishing the wires through the wing requires some patience, and it is best to follow the instruction manual's tip of using a string with a weight on one end. Two-sided tape, hot glue, CA, or almost any adhesive could be used to hold the flap servos in their premolded pockets. The flap system also features easily adjustable linkages. To add retractable gear—should you choose to do so—simply requires removing the fixed gear and using eight screws to secure the retract units to the airframe. If your field welcomes a belly lander, you could omit the landing gear entirely. The stabilizer/elevator assembly slides into the fuselage and is pinned in with foam inserts. Pay attention to their orientation as these inserts have a taper at one end that will match the bottom of the fuselage surface when installed correctly. The 90-degree bends and plastic "keepers" are attached to preinstalled control horns on

the empennage end, and connectors on the servos make adjusting the tail surface's linkages easy. A single Phillips fastener under the magnetized top hatch holds the wing in place. This top hatch/turtle deck is long and allows plenty of access into the plane's interior. It's safe to say that pretty much any receiver and many battery sizes will fit inside this P-51, but in the model airplane world, lighter is usually better. Airscrew propulsion arrives to you premounted and wired up. A 1000Kv outrunner uses standoffs to achieve the correct distance from the firewall and is coupled to a 30-amp electronic speed controller. An aluminum prop adapter, a 10x7E composite propeller, and a striped spinner complete the model's business end. As for cooling the power system in flight, there is an opening underneath the spinner, which will funnel cool air through the fuselage, while an exit hole near the plane's rear will allow air to escape. Exterior finishes include plenty of panel lines, simulated exhaust stacks, and machine guns, along with a well-applied paint scheme and decals. A preinstalled pilot bust and instrument panel appear ready for action.

IN THE AIR

Having added the retractable landing gear, takeoffs and conventional landings were how I began and ended my test flights. Once the throttle was advanced and a little rudder was fed in, the plane rolled for 30 or so feet and was ready to fly. I pulled up lightly, and the plane gracefully climbed out like a champ. Turns could be performed slower than anticipated, and there were no wobbles or oscillations at low or high speeds. Lining up for landing was easy, too. You just have to aim at your spot, bring the throttle back, and use the elevator to bleed airspeed. Fly it to the runway, and upon touchdown, it will roll for a second or two; at this point, I added up-elevator to plant the tail down. Taxiing around was simple and clean—no surprises and no bad habits.

GENERAL FLIGHT PERFORMANCE

Stability: My warbirds are typically balanced at the forward end of the recommended center of gravity, and that spot was spot-on for the test flights. The plane was stable in the air and on the ground, with no nose-over tendencies.

GEAR USED

RADIO

Tactic TTX650 transmitter and TR624 receiver (tacticrc.com); four micro servos installed; two Tower Hobbies servos for flaps & retracts

MOTOR

30-35-1000Kv motor; Flyzone 30A speed control (both installed)

PROP

Great Planes 10x7E (included)

BATTERY

ElectriFly 3S 2200mAh LiPo (electrifly.com)



Flying under the Eiffel Tower

If you've ever been under the Eiffel Tower, you know there is plenty of room to fly model airplanes there. But how about a full-scale P-51? In the spring of 1944, Bill Overstreet and his P-51C "Berlin Express" were near Paris when he spied and followed a Bf 109. The two planes had been in a running dogfight. The German pilot flew over Paris hoping that the heavy German antiaircraft artillery would solve his problem and eliminate Overstreet and the "Berlin Express," although Overstreet did manage to get some hits in at about 1,500 feet. The German's engine was hit, and Overstreet stayed on his tail, braving the intense enemy flak. His desperation undoubtedly growing, the German pilot aimed his plane at the Eiffel Tower and, in a surprising maneuver, flew beneath it. Undeterred, Overstreet followed right behind him, scoring several more hits in the process. The Bf 109 crashed, and Overstreet escaped by flying low and fast over the river until he had cleared the city's heavy antiaircraft presence. Talk about a rush!



There's brave and there's bold.
Pilot Bill Overstreet was both.



Tracking: Since only two clicks of trim were needed to fly comfortably across the sky, it's safe to say that the "Berlin Express" does a good job of staying in its own lane.

Aerobatics: The rolls are actually quite linear, which, dare I say, was surprising. There is adequate power for performing any scale-type maneuvers as well as sportier moves.

Glide and stall performance: Slow-speed handling tests never led to a stall, but to be honest, I didn't push it too slow because I like this plane and didn't want to damage it! The glides are smooth and predictable.

PILOT DEBRIEFING

The 40-inch-span foam "Berlin Express" behaves like a fun sport plane in P-51 "clothing" with a well-matched power setup and speedy performance. Decent batteries for this plane can be found for \$10.00, but if you want better performance, expect to pay closer to \$20.00 per pack. Many of us have 3S 2200mAh LiPos lying around, and I can't think of a better way to cycle them!

BOTTOM LINE

This is a cool-looking model subject and only requires minimal final assembly. There are no difficult steps, so you should start charging your flight pack before you begin. From the time you open the box, you could have the plane in the air within an hour. Add a little more time to that if you decide on having operational flaps and retractable landing gear. Don't forget to put the new prop on your balancer to check it out, just in case. +



Let's face it: The main focal point for any scale airplane is the cockpit. It is your duty as a scale modeler to add detail to surround your pilot figure.

HOW TO

Make Scale Cockpits

DETAILING THE PILOT'S OFFICE

TEXT & PHOTOS BY LYLE VASSER

Rule number one of scale model aircraft: Whoever brings a scale aircraft to the field shall not bare an empty hole of visible pushrods, servo wires, and raw balsa where a scale cockpit should be! That's right—it's the law! There is nothing more disappointing for an aviation aficionado than to view a fabulous scale model aircraft, look into the cockpit and see...nothing. If you have a scale aircraft, you simply must detail that cockpit.



Scale cockpit interiors, especially with open-cockpit planes like this Ryan, must be addressed for the model to look complete.

WHERE TO START

Luckily for most ARFs and kits, there are cockpit kits of various detail and quality. If you have never detailed a cockpit, this is a great place to start and will allow you to achieve satisfying results. After I purchased my first cockpit kit, it really got the creative juices flowing on how the task is done and how simple it is to create believable switches, knobs, and dials. You also realize that there really isn't much in a cockpit kit that you can't create yourself. Also, in the age of Google, photos are available of entire cockpits, and details like instrument panels, rudder pedals, yokes, and K-4 gunsights can all be found online for most aircraft. There's really no excuse for not having a good reference, which will help determine how well detailed your cockpit will be.

DEGREE OF ACCURACY

You should always decide on the degree of accuracy you wish to attain before building any scale kit. Are you going to make this an accurate rivet-for-rivet Top Gun champion or just something to give your RC buddies some warm scale fuzzies? Also, be aware that there are very few true-scale, panel-line-to-panel-line kits (especially ARFs) out there. They just don't exist in our hobby. Try to discover where the inaccuracies are in your kit before you get too invested in your detailing onslaught. Then plan where you can make things more scale and where you are just going to fudge it. And for the sake of time, also be aware of what's going to be seen and what is not. A lot of the cockpit is going to be covered up by a pilot figure, for example, so don't spend tons of time on seat belts and rudder pedals if the pilot is going to cover them up. It has been covered in other articles how to make specific details, so I'll just cover a few of the things that work for me that you may not have heard of. Remember: Nothing in a model cockpit is functional; it just has to look that way, and I feel that the quicker and cheaper I can arrive at that, the better.

I usually focus my attention to make the major components—instrument panel, seats, throttle, gunsights—accurate. Since I know quite a bit about tricks with paint, I view the elements in the cockpit as 3D effects that can be enhanced with paint. Generally, the more "real" the piece looks before painting, the better it will be.

Take, for example, the instrument panel. You can get a realistic illusion with a photo of an instrument panel, but the more 3D elements you can add to the panel, the better. Most cockpit kits give you a vacuum-formed instrument panel. I like to cut the holes for the instruments, and instead of using the supplied decals, I try to find photos of the actual instruments online. Find a piece of clear plastic, glue that to the back of the panel with epoxy or foam-safe CA (so you don't fog it up), then glue the instrument photos to the back of that. Where screws are seen in the panel, I usually use either dots of silver paint or gel CA. For gyro knobs, you can glue in place a piece of wire or the little red tube (from a WD-40 can).

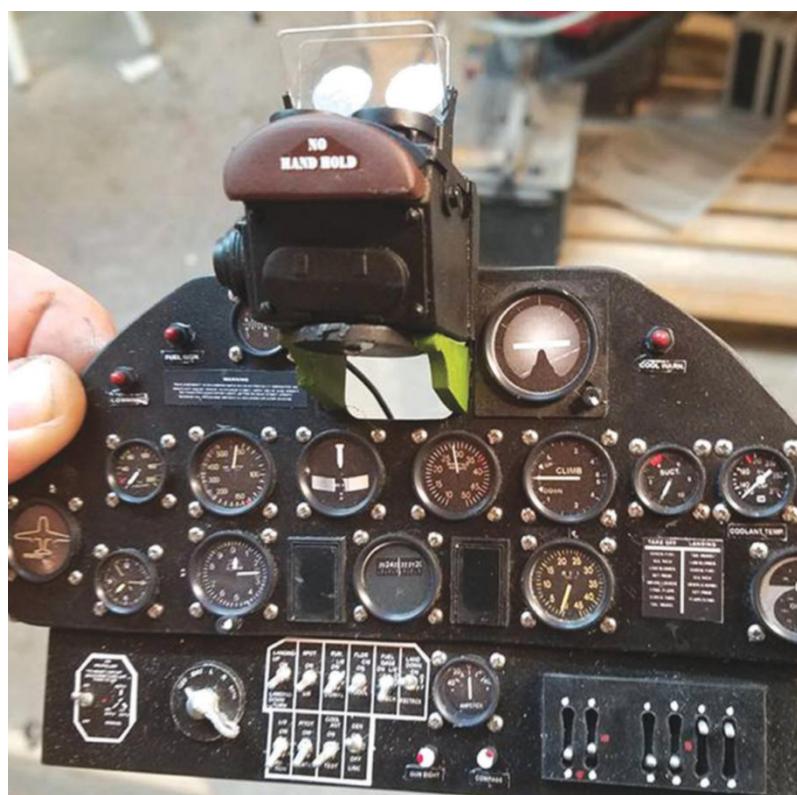
For access panels, I prefer shelf paper with permanent adhesive on the back. Some use aluminum-foil duct tape, but I find that can wrinkle and dent easily. The shelf paper takes all kinds of paint well, and it is easier to cut. It is surprising how much that little 1/32-inch-thick square adds to the texture of a blank panel. For toggle switches at 1/5 scale, I just use baling wire and snip off 1/8-inch pieces of wire and either poke them into the soft balsa or holes drilled in the plastic side panels. A little CA glue and it is fixed in place. Full-scale flip switches are flat on the ends, but I have found that really isn't noticeable at sizes of 1/4 scale or smaller.



Left: Just look at the eye candy under this canopy. It would be a crime to leave all this detail off your otherwise scale airplane.



Below: Here is a typical side panel from a commercially available cockpit kit. Adding the detail and painting it before installing it in the cockpit is a lot easier than trying to do it after it is in place.



Here's what can be done with the instrument panel with just a little extra effort.

HOW TO MAKE SCALE COCKPITS

CRAFT FOAM

One building material that continues to surprise me is craft foam sheeting. This stuff is inexpensive, feather light, flexible, and super-easy to cut, and it glues easily with foam-safe CA. It is my go-to material for items that need to look like curved metal, such as ammo chutes. I've also used it for radio boxes, louvers, and fake stringers/stiffeners in fuselages. Another bonus (if it is a space that you have to get into once in a while) is that these pieces are flexible, not brittle, so they bend instead of breaking off. It is easy to bend, and with a little heat from a heat gun, it stays that way. Metallic paint creates a convincing item made out of metal.

Almost all modelers are aware of JB Weld. A longtime friend of mine, Olen Rutherford, enlightened me regarding JB Weld for use as an inexpensive substitute for Milliput, the fine scale epoxy modeling compound. JB Weld is a bit runnier—at first. But after it starts to set, it is quite malleable for at least half an hour or more, which is usually enough time to sculpt finer items like knobs, door latches, and even control yokes. It's great for most things you could use epoxy compound for but at about a 10th of the price. The downside is that it can be heavy used in quantity, but for small items, it isn't a problem. It can even be used to give a better shape to an existing part. You can shape a control yoke, for example, out of coat-hanger wire, then coat it in JB Weld, which can then be shaped thin or thick to arrive at the correct shape. When cured, it can be sanded, filed, and drilled to arrive at the desired shape.

Another excellent material for adding texture is gel CA. This stuff won't run! It is awesome for building, but I find it also great for putting down rivets, buttons, and switches that are down low in the cockpit and are not too closely looked at. Sometimes we are just going for texture and not accuracy. Dip a pin, toothpick, or a juice-box straw in a bit of gel CA and dab it in lines for rivets. Then give it a spritz of accelerator and it's permanent.



Working on one item at a time, you can really add realism to the pilot's front office. (Airplane built by P. J. Ash)



Here is a Corsair with a Best Pilot in the seat. You don't have to worry about any of the details covered up by your pilot figure. There's still a lot to look at around the pilot. Subtle highlighting makes a big difference.

PAINTING TIPS

Gradients. I have observed that any object painted a solid color, no matter the color, is boring. But if you modulate that color, by making it a just a little darker or a little lighter in one direction or another, it grabs the eye.

My least favorite way to paint is with an airbrush because, let's face it, an airbrush can be a finicky pain-in-the-tuckus; however, it can give you subtle gradients like nothing else can. One of the best ways to achieve a subtle gradient with an airbrush is to start with your base color and, as you move upward, add a little white or gray to the color directly in the color cup of the airbrush. Darken your colors more toward the corners as well. Again, to mimic light and corners in airplanes, get darker with a little dirt and grime here and there.

Shading. After applying a base coat with subtle shading, I usually follow with a dark wash to enhance shadows and to bring out panel lines and other details. I almost always use water-based acrylic paint, so be aware that some of this won't work with oil-based paints or enamels.

Dry brushing. Also known as highlighting, dry brushing is the counterpart to shading. Now that you are thinking you ruined your cockpit by making everything look too dark, this part lightens things right up. Remember earlier, when I mentioned texture? All the raised bits are going to grab the little bit of the light paint from your brush and will



The deeper down in the cockpit, the darker your painting should be.



RECIPE FOR A DARK WASH

Start with one part Future floor polish, plus four parts distilled water. Then add 1/4 part black acrylic ink and 1/4 part brown paint. You're aiming for a semi-transparent warm gray—not pure black. A brownish black with a hint of rust is perfect. Then to really make this wash flow into every nook and cranny, add a couple of squirts of my special super-secret ingredient: Tilex shower cleaner. I've been using this stuff for years to improve the flow or runniness of water-based paint. Please note that Tilex is only compatible with water-based paint. Tilex eliminates the surface tension of water, so it becomes super runny. After applying the wash, I usually blot the area with a rag to wick away excess shadow wash. Let dry before continuing.



Subtle weathering in and around the cockpit also gives your model that lived-in look that's so important to any scale warbird. This F4F Wildcat is the work of Lee Watkins.

become quite noticeable. To get your brush to cooperate with this technique, it shouldn't be good brush. Mine looks like it has been in a fight! The fluffier and more splayed out the bristles, the better. Think "makeup brush." Dip the brush (just a bit of it) in an off-white (I use Model Master Acrylic Sand), gray, or a lighter shade of your base color, and fan and dab the paint-loaded bristles on a rag until you barely see any paint coming off. You are now ready to highlight. Quickly fan the bristles over the area you



The overall effect using paint to add gradients, dark washes, and highlights adds tremendously to your model's realistic appearance. Steve Forrest built this great F4U Corsair and added the scale Pappy Boyington from Best Pilots.

want to highlight as if you are putting out a fire. You should immediately see a subtle effect with your raised areas.

With the shading/wash and the highlighting, what you have done is really pushed the depth of the detailed pieces more, and with the highlighting, you pulled out the higher parts just a little more. This makes up for the smaller size of the elements in our scale models and forces it to play with the light in a more dynamic way, just like its full-scale counterpart.

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HOW TO MAKE SCALE COCKPITS

ONE MORE TRICK

One little trick that I have discovered recently that works a subtle magic on my pilot figures is to take baby powder and a super-soft brush and apply some of the powder on highlighted areas. I then spray on a protective coat of Testors Dull Cote to protect and matte the finish.

At first, it really looks like too much and can be scary. But when the Dull Cote hits it, something weird happens and the light-colored pastels and powder become translucent. I find that this softens all the colors and any harsh gradients, making the finish even more matte—a desirable thing for a scale warbird.



Details and painted highlights aren't just for the cockpit. Any crew compartment, like this side gunner position in an RC PBY Catalina, benefits from added eye candy. Of course, all the wood surfaces will get the painted highlighting treatment.



Before: This bulkhead hatch door was made out of simple plastic parts, strips of aluminum-foil tape, and bits of balsa.



After: After applying some paint, dark wash, and highlights, the hatch door looks very convincing.

BOTTOM LINE

As with anything new, start out small and work up. Detailed cockpits are small projects within the larger model-airplane project, and the feeling of accomplishment you'll receive for a job well done is satisfying. Plus, you will amaze your fellow club members. Give it try. †

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E-flite/Horizon Hobby UMX Cessna 182

A maximum-fun, minimum-size monoplane

BY MIKE GANTT PHOTOS BY JOHN REID



Founded by a farmer named Clyde Cessna, the Cessna Aircraft Company underwent plenty of trials and tribulations. In 1932, Cessna was forced to close its doors due to the Great Depression. Then just a year later, Cessna rolled out a race plane, won the American Air Race in Chicago, and set a new world speed record. The next year, Clyde sold the company to his nephews, who turned the business into the successful giant we know today. Many of us have had or will have our first general-aviation flight in a Cessna because they're safe, ubiquitous, and easy to fly. Cessna model aircraft are also popular, and pilots love flying them.

Recapturing the concept of the Cessna 182 Skylane, this ultra micro foam has an authentic outline and plenty of detailing. Offered as a BNF (bind-and-fly) basic kit, you will need a DSM2/DSMX-compatible transmitter and a small 280mAh 2-cell battery pack. There is no assembly required—just fun to be had.

AT A GLANCE

MODEL	UMX Cessna 182
MANUFACTURER	E-flite (e-fliterc.com)
WINGSPAN	25 in.
PILOT SKILL LEVEL	Intermediate
ASSEMBLY TIME	None
RADIO REQ'D	6-channel DSM2/DSMX
POWER REQ'D	2S 280mAh LiPo
PRICE	\$129.99

WHAT WE LIKE

- ✚ Go anywhere and fly
- ✚ SAFE Select and AS3X stability
- ✚ Excellent detailing
- ✚ Spirited performance



EVEN IN A BREEZE, THE LITTLE PLANE FEELS SOLID AND FLIES LIKE A LARGER AIRPLANE THANKS TO EXCELLENT FACTORY PROGRAMMING.



UNIQUE FEATURES

A big brown van delivered a small brown box and inside was a full-photo display-type box. Within that carton was a cut-to-fit foam insert, which held the model safely despite a crushed outer carton corner. In addition to the complete assembled airframe inside, I found a piece of hook-and-loop tape and a multilingual

instruction manual. Since a DX18 and a couple of other 2-cell UMX planes were already in the hangar, I was able to use/share batteries and bind my radio immediately. The recommended flight pack is a tiny 2S 280mAh (2S 200mAh packs also work fine with just a little less flight time). One note is that these mini batteries only have a balance plug attached to them, so make

sure you get a proper charging adapter if you don't already have one.

Small is the theme here, but the UMX 182 delivers big on looks. The multicolored paint job and accompanying decals are sharp and easy to see. Panel lines and wing corrugations were identified and created in the foam-molding process. The density of the foam is high, and the surface is among the smoothest I've seen. Clear plastic windows are factory fit to the fuselage and look way better than the "glass" decals that some other models use. Plastic wing struts are preinstalled and are easy to remove if needed as they employ a simple tab-lock system. The wing itself is held in place with pieces of double-sided tape and clear tape. The ailerons also use clear tape for their hinging, as do the tail feathers. All control linkages are adjustable and are operated by real rotary servos rather than the linear actuators we've become accustomed to. These ultra mini servos are cute, to say the least, and do a great job running on the AS3X protocol. AS3X is built into the onboard receiver and is what affords pilots the option of flying model airplanes of this size with such amazing control. Even in a breeze, the little plane feels solid and flies like a larger airplane thanks to excellent factory programming. The brushless power system starts with a 2500Kv outrunner, and a built-in speed control is coupled to the aforementioned receiver. A 5-inch prop, a painted spinner, and cowl inlet holes look cool and will help the electronics stay cool.

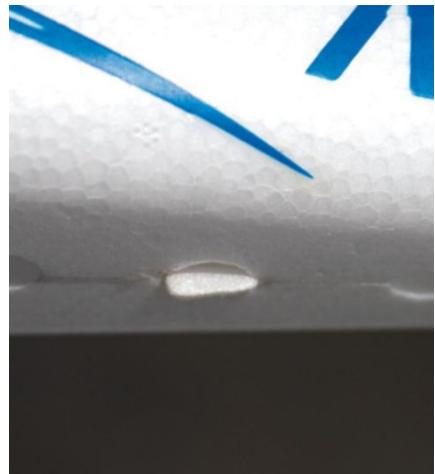
IN THE AIR

Read and follow the binding process and you'll be good to go. This UMX Cessna's landing gear looks good and can be quickly removed for belly landings. The steerable nosewheel allows for some tight maneuvering. I have 18-inch-square tiles on my floor, and the UMX 182 can roll in circles within one of them. Taxiing around the house really lit the fire, and waiting for test-flight day really tested my patience. As expected, the plane does well on the tarmac and is easy to line up for departure. Plenty of power is available, and rollouts can be quick and short; a hand launch is just as easy with a gentle toss. After shooting your touch-and-gos and testing the aerobatic abilities, it is eventually time to land. It almost seems as if the plane wants to land itself, with minimal inputs required to set it down softly.

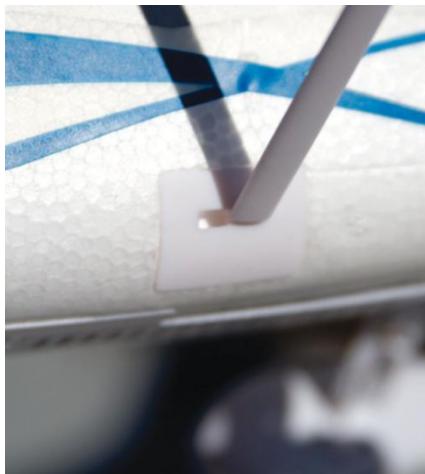
GENERAL FLIGHT PERFORMANCE

Stability: Even though the plane only weighs a quarter pound, it feels bigger in flight. The AS3X fights off turbulence and helps stability in less-than-perfect conditions. Slow-speed handling is remarkable, and tight rudder turns were a sight to see as it does them with ease and without issue.

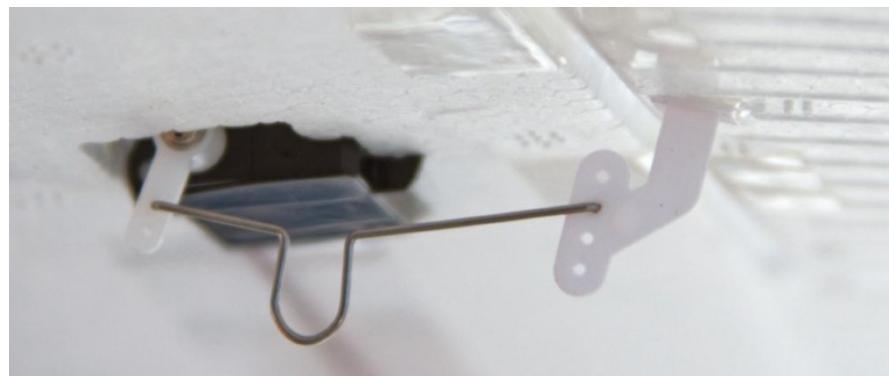
Tracking: In flight, some quick trimming made the plane fly quite well where pointed. It does



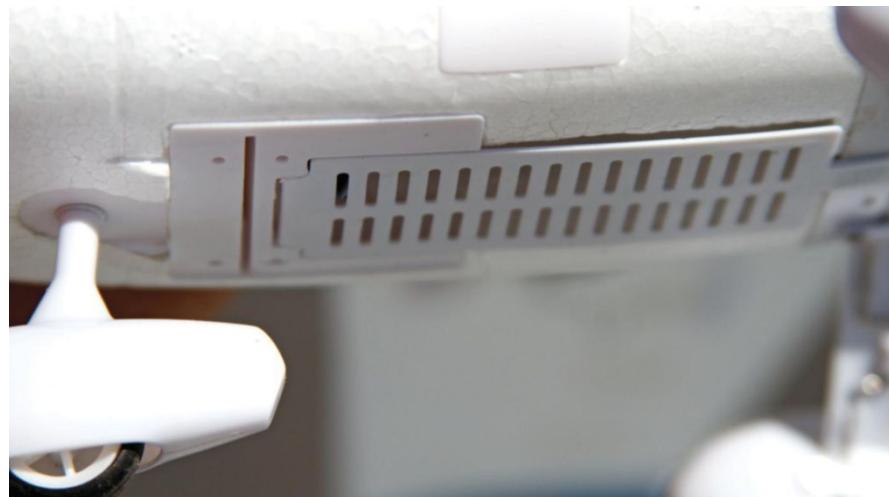
The author added on a small piece of 3mm Depron foam to mimic an ADF antenna.



The wing struts are easy to remove if needed.



Small rotary servos are tucked into molded pockets and work well.



A magnetic, hinged cover conceals the flight battery.



GEAR USED

RADIO

Spektrum DX18G2 (spektrum rc.com), DSMX all-in-one receiver, and four micro servos (installed)

MOTOR

180 brushless 2500Kv (installed)

PROP

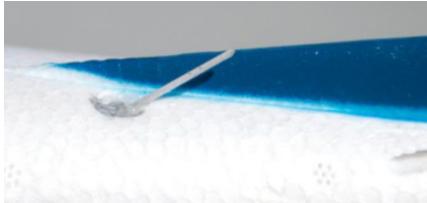
5x3 (installed)

BATTERY

E-flite 2S 280mAh 30C

Scale Details

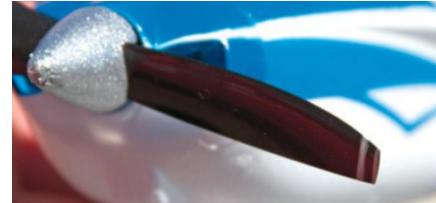
The UMX Cessna 182 has a ton of scale detail, but you can really trick it out with a few simple additions:



■ Antennae. I spray-painted white a small piece of carbon-fiber rod and allowed it to dry. After cutting it to size, I glued the rod in a “scale-ish” location with a tiny dab of contact adhesive. I also added a small piece of white Depron to the bottom of the fuselage to mimic an antenna there. You could add more antennae, but UMX planes need to be light, so choose your materials with care.



■ Tie-downs. The full-size 182 is lightweight, so it could be blown around while parked. I made a tail tie-down out of a 1-inch-long, 23-gauge micro-pin finishing nail. I easily bent it using some pliers, then trimmed and glued it into place. This is my favorite addition, and I may add two more of these to the wing struts soon!



■ Stripes. Prop warning stripes are always a good idea. After looking at a few examples online, I put my silver felt-tipped marker to work freehand. Since the marker ink adds no noticeable weight, there was no need to rebalance the prop. This was so simple and effective that I'll likely be adding similar stripes to more of my models.

a good job tracking through maneuvers, especially for being as small and light as it is. **Aerobatics:** There is plenty of authority to fly inverted circuits and perform tight or large loops and many of the basic/intermediate aerobatics, but to be honest, I found myself doing a lot more cruising around and shooting a few greasy touch-and-gos.

Glide and stall performance: Minimal size and weight typically means minimal inertia. That said, the slow-speed handling of the UMX 182 is amazing. Once you do force the plane to stop flying, the stall is mild, and there is plenty of power to pull the airframe out of it if necessary.

PILOT DEBRIEFING

Its small size and landing gear on/off option allows the UMX Cessna 182 to fly almost anywhere, while its scale details make it look good everywhere. The preprogrammed guidance system simply binds to any DSM2/

DSMX transmitter and features an excellent training feature: SAFE Select, which works extremely well keeping the airplane from doing anything scary. This helps provide aspiring pilots with successful flights—and smiles.

BOTTOM LINE

Mini but mighty, the UMX Cessna 182 is a capable and fun-to-fly model airplane. Batteries are inexpensive, and a few of them will keep you in the sky for quite a while. The AS3X and SAFE Select modes make it easy for newer pilots to have happy, successful flights while working with full 4-channel controls. +



So what's wrong with this picture? Yes, it is a beautiful AT-6 Texan, but it's missing not one but two pilot figures! No scale airplane should leave the ground with an empty cockpit.

HOW TO

Scale Pilot Figures 101

WHAT YOU NEED TO KNOW FOR PROPER SCALE APPEARANCE

TEXT & PHOTOS BY ADAM MARTIN

After spending a lot of time in the workshop, your new warbird is all assembled and standing up on its gear ready for its first trip to the flying field. But something just doesn't feel right. It's something that's often overlooked, and it really does make the difference in how your airplane looks. That one last detail needed before it's ready to roll onto the grass at your local field? A scale pilot figure, of course!



When selecting a pilot figure, it has to match the size and type of airplane model you are building. Here, a Japanese Zero has a proper pilot figure to complete its scale looks.

First, let's get something straight. A scale model RC airplane should never leave the ground without some sort of figure at the controls. There is a little bit of homework you'll need to do before filling the cockpit. Depending on the type of airplane you're building, you need to know what size and type pilot figure you'll want to install. Do you need a full-length pilot, or will a pilot bust do the trick? What era and branch of military and what country was your airplane used in? This is important as the wrong type or size pilot is almost as bad as having no pilot figure at all. When I was first getting started in RC scale modeling, I was pretty disappointed with what was available. That's one of the reasons why I started my company, Warbird Pilots, to offer affordable, good-looking, poseable pilots that would look accurate in any scale model.

SIZING THINGS UP

The most popular pilot sizes are 1/8, 1/7, 1/6, 1/5, 1/4, and 1/3 scale. There are World War I, WW II, civilian, and jet pilot figures. With all the factors involved with various airplane manufacturers, there can be a wide range in cockpit sizes (including depth and width). Using figures that are poseable is helpful when you consider items such as seat, instrument panel, and joystick location.

And since all cockpits are not created equal, having a flexible poseable pilot makes it a whole lot easier getting everything to fit and look natural. Unlike plastic figures, the clothing and equipment are removable and adjustable, so you can alter the appearance of your pilot. Raising or lowering the goggles; attaching the oxygen mask or letting it hang to the side; and removing the parachute pack, life vest, shoulder harness, and even its jacket give you the ability to get the pilot to look exactly the way you want it to for your airplane.

PICK YOUR PILOT

Several manufacturers will list the scale size of their model, but this may or may not be exactly what the aircraft truly is. Since full-size flesh-and-blood pilots come in a lot of different heights, various-size pilot figures can be used with a wide variety of airplane sizes. For example, 10-inch pilots can be used with 1/8- to 1/7-scale planes, and 12-inch pilots will fit nicely in 1/6- to 1/5-scale planes. A pilot that's 15 inches tall will work with 1/4.5- to 1/4-scale models, and a 22-inch pilot can be used in 1/3.5- to 1/3-scale aircraft. When it comes to pilot figure size, if you can find the exact size needed for your model, you should lean toward a pilot that is slightly larger than scale. A pilot that is too small for the cockpit looks more out of place than one that uses up a bit more space.

With the size of your plane and pilot determined, you next have to figure out what style of clothing and gear are needed for your scale airplane. In 1942 or so, the fighter pilots in the South Pacific wore lightweight khaki (light tan) uniforms and yellow May West life vests. In the cooler climates of the European theater, U.S. Army Air Corps pilots would wear heavier gear and often leather flight jackets. British Royal Air Force pilots used different-style head gear and goggles, and their flight suits were usually blue. The same thing goes for German Luftwaffe pilots and Russian/Soviet pilots. You want to get the details and gear right for the best scale looks.

POSITIONING

The next step is to determine approximately where the pilot's head should be when the figure is sitting in the cockpit. Go online or to your reference documentation to find photos of the airplane you're building and photos showing the pilot in the cockpit (during flight). Some aircraft had the pilot riding high in the saddle, showing



Here is a Comp-ARF P-51D Mustang with the canopy slide open. The 15-inch WW II USAAF pilot figure is perfectly accurate for this warbird.



To install a pilot figure, remove the canopy and set the pilot in position. Refer to photos to determine what the proper height should be for the pilot.



Here you see the pilot is way too tall in the saddle.



Properly positioned, the figure should sit with a bit of space between the top of its head and the canopy.

HOW TO SCALE PILOT FIGURES 101



some shoulders and parachute straps. Other planes would have the pilot seated much lower, with just the top of the pilot's head showing. Compare the pilot's position with the framework and canopy to see what will be appropriate for your airplane.

With a good idea of how the pilot should look in the cockpit, you can now properly position your pilot figure. Start by bending the figure naturally at the waist, just below the jacket, and seat the figure sitting on its parachute pack. Based on this basic seated position, there will be three results for the first test fit. The figure will either sit too low, too high, or just about right. If the figure fits just right, congratulations! Now secure your pilot, attach the canopy and go flying! But if it needs adjustment, this is pretty easy to address.



The height of the pilot is even more evident with vintage WWI open-cockpit biplanes. This 1/3-scale WWI pilot is sitting just about perfectly for this Nieuport.

For a pilot that's sitting too high, the first adjustment can be made by simply removing the parachute pack or removing its filling. This will lower the pilot an inch. If the figure is still sitting too high, you can then straighten the figure and rebend it higher up above the waist. As you can see in the photo, this will allow the figure to sit another inch lower in the seat.

With the lower seated height, you may find your figure with extra-long legs. This is no issue; either put the legs under the instrument panel, or remove the boots and fold the legs under. A more drastic solution is to use a pair of scissors and cut the legs to the desired length to fit under the instrument panel. I prefer to just fold them under so that the figure's integrity is preserved.

Securing the pilot within the cockpit is also important; we don't want the it rattling around during flight. A quick and easy way to secure the figure is to drill two small holes in the seat (one on each side of the figure), wrap a zip tie around the figure's waist like a seatbelt, then secure the figure to the back of the seat with a small piece of Velcro double-sided tape. Before reattaching the canopy, bend and adjust the pilot's arms and hands so that one hand is holding the joystick and the other hand is on the throttle. A small dab of glue will secure their positions. It is also good to position the pilot's head so that the figure is not just looking straight ahead. If you turn its head so that it is looking slightly to the left or right, the pose will look more natural.



A Pilot for Every Plane

With more than 50 different pilot figures available, you can outfit almost any airplane with Warbird Pilots. Company owner Adam Martin has designed his scale pilot figures to be incredibly lightweight and easy to pose. The scale clothing and equipment are historically accurate and easy to remove or adjust. And if you like the animated pilot head setup, Adam can also add this option to any of his scale pilot figures. (All pilots shown in this article are from Warbird Pilots.)

—The Model Airplane News crew

warbirdpilots.com

Adam Martin is shown here at his tent at the recent Toledo RC Expo event. A scale warbird modeler, Adam started his company because he could not find quality pilot figures that were affordable.

BUSTING A PILOT

Not all airplanes have full-depth cockpits, and several come with a deck intended for the use of a pilot bust. When it comes to cotton-filled full-body and wire-frame pilots, you can also cut them down to size. Remove all the scale equipment and clothing, and simply use a pair of scissors to cut at your desired location. Take measurements from the cockpit deck to the top of the canopy, refer to your documentation for pilot height, and snip away. Use a pair of wire cutters to cut the wire frame.

Make a 1/4-inch balsa or plywood base to fill out the bottom of the pilot figure. The two frame wires should be inserted and glued to the wood base. Then glue the cotton body to the sides of the base to close up the figure. All the clothing and equipment can be put back on the figure and trimmed to the proper length. With this done, position your pilot bust and glue in place. For this article, I used a cut-down 12-inch-tall, 1/5- to 1/6-scale WW II USAF pilot figure for my Hangar 9 P-51D Mustang.



By removing the lower half of the pilot, you can make full-length pilots into great-looking pilot busts.



Here, the cut-down pilot fits nicely in the author's Hangar 9 Mustang.



Here, you see the base of the pilot bust glued to the cockpit deck, which is painted black. All the upper equipment and scale details are retained and trimmed to length.



For an added bit of animation, you can also add a servo-operated head to your pilot figure or bust. Connect it to the rudder channel with a Y-harness or to a separate auxiliary channel and you can have on-demand head movement.

ANIMATED HEADS

If having a highly detailed pilot figure in your plane just isn't enough, you can also animate your pilot's head so that it moves with the rudder. This way, the pilot can clear the way as the plane taxis to the runway. Install a servo in the upper chest of the figure and then connect the pilot's head directly to the servo wheel. Direct the servo wires down inside the body and have them exit at the bottom of the pilot's pants. Use a Y-harness to connect the pilot servo to the rudder, or use an auxiliary channel for on-demand head movement. The job is fairly easy, and the setup works well inside a pilot bust. +

Parrot Disco

A fast-flying wing for any pilot skill level

BY JOHN REID PHOTOS BY CHERYL VOMACKA MALTBY



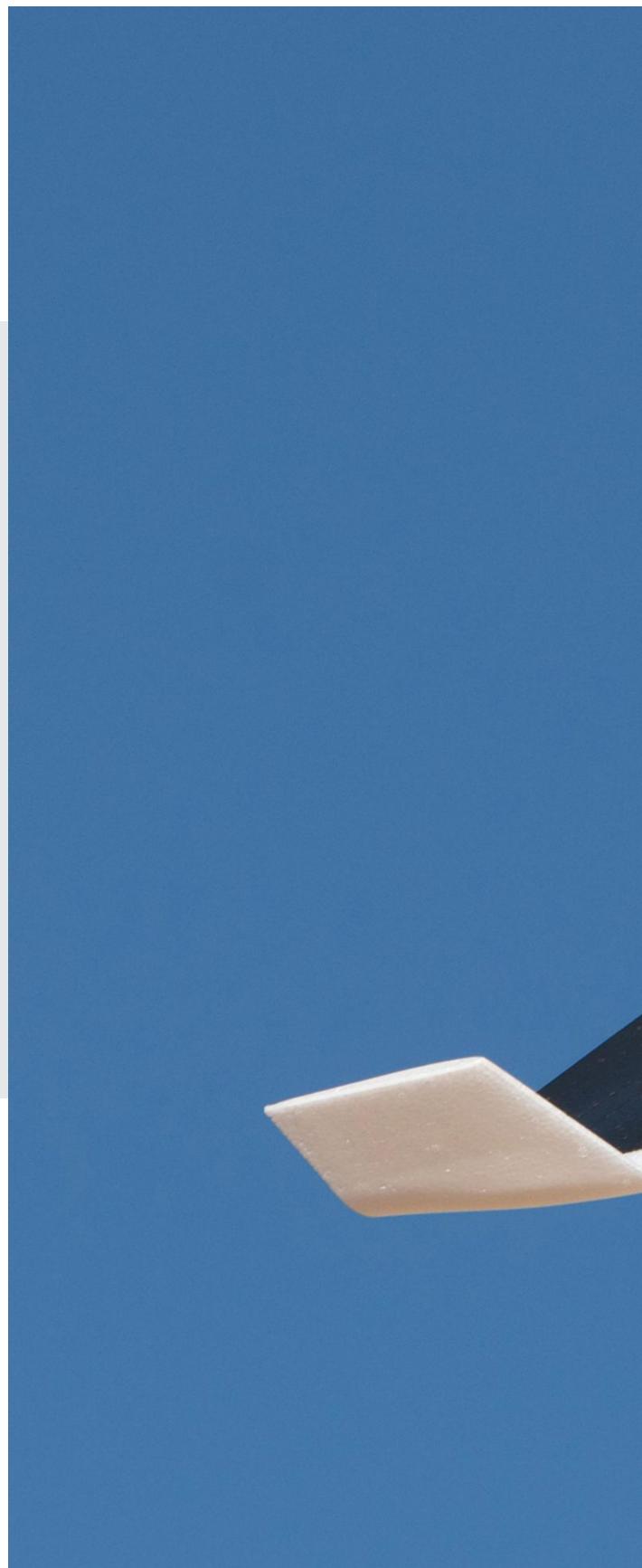
When you're flying first-person view (FPV), having an aircraft that can take off and land by itself means that you can concentrate on immersing yourself in the aerial view. The Parrot Disco is a fun and enjoyable plane to fly, and its construction quality is up there with the best in the market. This flying wing has light carbon and an EPP (expanded polypropylene) body that is durable and will stand up to a lot of use. My review setup included everything needed to get this bird in the air, and I just had to add a smartphone or tablet. The wing requires little assembly, and all the flight controls come factory installed. The included Parrot Skycontroller 2 is bound to the Disco and only requires a charge. Also in the box are the Parrot Cockpitglasses, which, when used with a smartphone, will give you a bird's-eye view from the drone. This immersive view makes it feel as if you are flying inside the aircraft.

The automation designed into the Disco makes it easy for inexperienced pilots to fly. Most of my review flights were done using the Autopilot mode, but if you want to fly this as a normal wing, just switch to Manual mode. Autopilot mode is nice when wearing the Cockpitglasses and flying over some nice scenery that you just want to enjoy without worrying so much about the flight controls.

AT A GLANCE	
	MODEL Disco FPV
	MANUFACTURER Parrot (parrot.com)
	WINGSPAN 45 in.
	PILOT SKILL LEVEL Beginner
	ASSEMBLY TIME 5 minutes
	RADIO REQ'D Included
	POWER REQ'D 3S 2700mAh (included)
	PRICE \$899.99

WHAT WE LIKE

- + Simple take off and auto landing
- + Solid single-stick flying
- + Long flight time
- + Parrot Cockpitglasses for FPV experience



THE PARROT DISCO FPV PACKAGE IS THE PERFECT SETUP FOR NEW PILOTS WHO ARE LOOKING FOR A UNIQUE WAY TO SEE THE WORLD. THE DISCO HAS SOLID FLIGHT PERFORMANCE, AND I DID NOT HAVE ANY ISSUES WITH INTERFERENCE WHEN USING THE ONBOARD CAMERA.



UNIQUE FEATURES

The Disco comes in a box that you can use to store it when you aren't flying. Included in the box is a wall charger, which is designed to work with both the flight battery or controller battery but can only charge one at a time. So I started that process right away.

The wings need to be attached to the body, and they have rods extending out from them that are inserted into the side of the fuselage until they snap in place. It is important to make

sure that the grooves from the aileron-servo control horns clamp over the aileron control surfaces on the wings as they will control the aircraft. That is the extent of the assembly required; then you just install the battery and download the FreeFlight Pro app onto a smartphone or tablet. The Disco has three different piloting configurations. The first uses just the Skycontroller, and it is like flying any other RC airplane. Alternatively, you can configure the Skycontroller with a smartphone



Start the wing assembly by lining up the carbon-fiber rods with the holes in the fuselage and then push the wing in.



Continue sliding the wing in until you hear a "click" and the wing is locked in place.



Left: Be sure that the aileron servo tab lines up with the control surface. **Right:** The bottom sensor lets the Disco know when it is getting close to the ground.

GEAR USED

	RADIO
Parrot Skycontroller 2 (included)	
	MOTOR
1280Kv motor (included)	
	PROP
Foldable 8-in. (included)	
	BATTERY
3S 2700mAh (included)	

or tablet in much the same way that many drones operate. Finally, using the Skycontroller with the Cockpitglasses gives you the feeling of flying like a drone racer.

For my first few flights, I used the tablet for the app, which requires the smartphone holder (also included) to be attached to the Skycontroller. I had to update the Disco and Skycontroller 2, so I did that at home because it required a Wi-Fi connection. Before the first flight, I had to create a Wi-Fi connection from the tablet to the Disco so that all would talk to each other. The warning light flashed, which indicated that I needed to calibrate the Disco's gyroscope. The instructions are clear on how to do that, and it only took a few minutes to rotate the plane around all three of its axes. With that done, I started learning what all the function buttons on the control screen do. I also topped off the battery—not that it was necessary with the Parrot's 45-minute flight times, but I just wanted to get the maximum amount of time in the air. It was now time to hit the flying field.

IN THE AIR

At the field, the first thing to do was turn on the Disco and then the Skycontroller 2, which take a minute to bind. I opened up the setting menu on the tablet to make the connection to the Disco Wi-Fi. Now when I opened up the FreeFlight Pro app, I could see the camera feed from the front of the aircraft. There is a tiny bit of lag, maybe half a second, but I did not find that to be an issue. Take off is easy: I held the Disco by the front leading edge of the body part (not the wing), hit the takeoff button on the controller, waited for the motor to come up to speed, and threw the airplane. I didn't touch the controller; the plane automatically levels out, climbs to a preset altitude, and flies a 60m-diameter circle until a new command is given by the pilot.

GENERAL FLIGHT PERFORMANCE

Stability: The Disco is very stable in the air at all speeds. The best part is that its autopilot unit maintains any altitude that is established by the pilot.

Tracking: It displays solid tracking performance. Most wings will drift, but this one



Controlling the Disco

While the Skycontroller 2 looks and feels like a normal transmitter, there are some differences when flying the Disco as compared to a regular RC aircraft. The first thing is the right stick: When pushing it left or right, the Disco responds like any other aircraft, turning left and right. But when you use the elevator stick, there is a slight difference. Pushing forward, the wing will go down, but the motor will automatically throttle back without any need for the pilot to adjust the throttle stick. The same thing happens when entering up-elevator: The Disco goes up and the throttle automatically increases the speed of the motor. This motor-speed increase is proportional to the amount of up-elevator input. Pushing left or right rudder stick does make the wing fly that way, but it will also keep it in that turn until corrected by the pilot.

The Return to Home feature is also a bit different when compared to most Return to Home functions on drones. Instead of returning and landing, the aircraft flies back to the transmitter and at a 50-meter altitude until it is over the starting point, at which time it will make a 60m-diameter circle above this position. There are two different landing modes that can be set up. The first is linear landing, and for this, you need to position the Disco facing upwind, press the Landing button on the controller, and watch the Disco descend in a straight line and land in front of you. On the FreeFlight Pro application, there is a Circular Landing button that, when pushed, starts the Disco into a circular descending landing spiral that slowly brings it down. This requires at least an 80-meter-diameter landing area with no obstacles.

maintains its heading well and will keep its line for some distance.

Aerobatics: In manual mode, the Disco will do all the aerobatics that can be expected with any wing. These include rolls, loops, and any combination of them.

Glide and stall performance: In Autopilot mode, it is next to impossible to stall this bird. When in Manual mode, it does take some work to make it stall, and the stall is mild and easy to rectify.

PILOT DEBRIEFING

This is an enjoyable aircraft to fly. The autopilot automation gives the pilot plenty of time to adapt to the RC flying experience. For experienced pilots, the smooth flight path allows for some nice-looking video. This same smooth flying makes it easy to set the Disco up on a consistent flight path again and again for photo shoots. By using the left rudder stick, you can put the Disco into a left or right orbital



standby mode. I was surprised by how often I used this feature. What I found impressive is that, when using the left throttle stick to speed up the wing, the Disco maintains its altitude and just goes faster. Throttling back does cause the wing to lose altitude, but when the stick is allowed to come back to center, it maintains the new altitude.

The foldable prop works very well and keeps the props from breaking during landing.

BOTTOM LINE

The Parrot Disco FPV package is the perfect setup for new pilots who are looking for a unique way to see the world. The Disco has solid flight performance, and I did not have any issues with interference when using the onboard camera. The signal to the tablet or smartphone was good and easy to use for flying, although most of my flying was done by line of sight. I recommend the Disco to anyone who is looking at getting into RC flying and having an aircraft that is easy to fly and can document the world from above. +

HOW TO

Easy Warbird Makeover

A NAVY T-28 TROJAN GETS A NEW LOOK

TEXT & PHOTOS BY RICH URAVITCH

This aircraft could be taxiing in Thailand in the late '60s. The camo scheme definitely adds to the warbird image of the T-28, along with all those neat external ordnances the author added to the basic Carbon-Z kit.



As a subject, the T-28 has clearly been a sleeper over the years, with only a small number of kits being available. Well, the lightning bolt must have hit a large number of people at the same time as the market now has Trojans in all sizes—from micro to ginormous! Why? Because in nearly any size, the subject works and flies well. New techniques in foam material and fabrication have provided us with some fabulous flying models that go together quickly and have us in the air in virtually no time. About the only downside is that they all come out of the box looking exactly like the next one. A particular model, if popular enough, sometimes can make it difficult to pick yours out on the flightline because everybody has one!



Accumulate your documentation before embarking on the project. Gather as many images as you can on the specific subject you plan to replicate.



The materials used for the project are shown here. Four colors of latex paint were color-matched to Federal Standard 595.

CHANGING THE LOOK

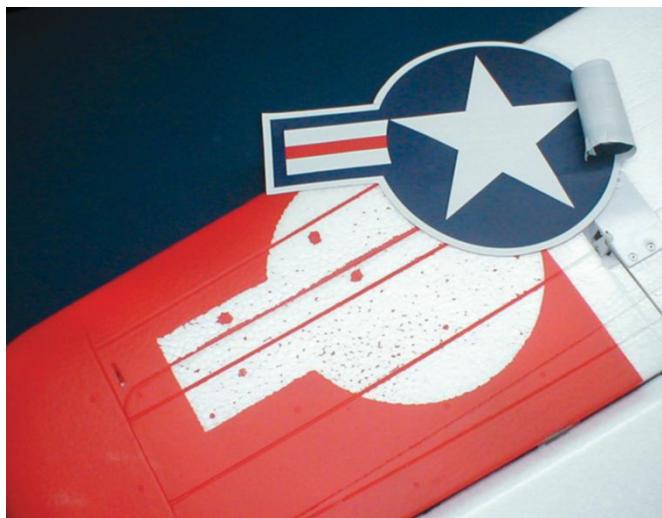
The process I used for this project is very easy and inexpensive, and produces attention-getting results in a fairly short period of time.

The changes in final appearance are dramatic. The first step in the process is simply to remove all the factory-applied markings. In the case of the T-28, these are stick-on Mylar, which adhere tenaciously and will remove most of the painted area underneath the marking when peeled away. It also disrupts the smooth surface of the unpainted foam. Apparently the molding process of some newer-generation foams creates a very smooth surface, which eliminates the "alligator skin" look. Unfortunately, that smooth surface to which the markings are adhered will be taken away when you remove them, leaving a textured surface noticeably different from the surrounding area.

Because the red painted areas of my T-28 were going to be difficult to cover with any kind of paint, I decided to prime the areas with a white latex primer brushed on with a foam-pad brush. To eliminate the "textured" areas created by the marking removal, I also covered those areas with the primer. Another coat or two to get a uniform white color to the surface and a light pass with 600-grit sandpaper to level things out and I was ready for color coats.

SCALE COLORS

As this is a scale model, I prepared a documentation package for a



The first step is the removal of all the preapplied kit markings. Start by lifting an edge and pulling the marking back on itself.

specific, full-scale Trojan that I wanted to duplicate and gathered as many pictures and color information that I could locate of the actual airplane. One of the many images that I found online captured my attention, and I decided that it was the one. It is a restored Trojan painted as a "D" model in the Southeast Asian scheme of four colors of the period. Armed with my Federal Standard (FS) 595 color deck, I headed off to my local Home Depot paint department to get some paint. You can buy small (7.2-oz.) sample sizes of any



The transparent areas of the canopy are masked with tape and paper.

One coat of white latex primer was applied overall with two more coats over the red/orange surfaces to even things up and improve color-coat adhesion.



HOW TO EASY WARBIRD MAKEOVER



color paint you want, and my store already had the FS-595 colors in its database! About half an hour and only \$16 later, I had all the colors needed for my project.

APPLICATION

The paints were used straight out

of the bottle, with no thinning required. I applied the bottom gray (two coats) first to all the undersurfaces, followed by the upper surface tan (two coats), and set the model aside to dry for 24 hours. The color demarcation line depicted in my documentation

was roughly approximated as I knew I would be "cleaning it up" later. Again referring to my documentation, I used a soft pencil to draw the camo pattern color-separation lines directly on the surface of the model. I then applied the two remaining colors—the

edges done using a quality brush and a foam-pad brush filling in the larger areas.

Some areas might require a second coat depending on the kind of coverage you've achieved. After the basic scheme had been applied, I went back over all the



Part of this makeover included the replacement of the single supplied pilot with a pair of Williams Bros. items, which I reworked to improve the realism.



I made up artwork to duplicate the markings for my chosen T-28 and sent it off to Callie Graphics for conversion to self-adhesive vinyl. They did an amazing job!



Close-up of tail group camouflage prior to "weathering." Compare this to the post-weathering image.

separation lines with an airbrush to "soften" the edges. I used alcohol rather than water to thin the paint to the viscosity needed to properly get it through the airbrush. This took a bit of experimentation with ratios to achieve the result that

I wanted. I also discovered that low-tack blue masking tape can be used for sharp color edges if the paint has been allowed to dry thoroughly. I'd suggest using a test area that can be easily touched up if the paint ends up separating



The "weathering" of the vertical fin includes chipping of the fairing edges, along with highlighting the fasteners and "fading" the colors.

from the surface.

Because the T-28 that I chose had some unique markings, I prepared some artwork and sent it off to Callie Graphics (callie-graphics.com) to produce a set of new self-adhesive Mylar

markings for my model. The company did an outstanding job, and in short order, I had the sheets back and ready to apply. I have to say that Callie duplicated to perfection what I had sent, and it was very reasonably priced for custom work!

After applying the markings, I used a water-based satin clear urethane, again applied using a quality brush to minimize streaks, followed by all the weathering, chipping, dirtying up, and streaking, which adds so much to the overall realism of the model. Exhaust stains were added with an airbrush.

When I was happy with the final look, I applied a light coat of flat acrylic spray to unify the finish of all the surfaces. As big as this model is, I still have enough of each color left to do another complete airframe! I was so pleased with the final result that I went a little further and made up a number of "underwing things"—like external fuel tanks, rocket pods, and machine-gun gondolas—to impart more of that "warbird" look. With all these additions and the new paint scheme, the big T-28 retains its great flying and handling qualities, and has become one of my favorite airplanes in my stable.

Go ahead and make your foamie unique and individual; this method should work on any of them! 



Though this big E-flite Carbon-Z Trojan is no longer available, this makeover technique works great for any foam warbird.

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E-flite X-Vert VTOL

Incredible flight capability in a ready-to-fly airframe

BY MIKE GANTT PHOTOS BY JOHN REID



If you, like me, are always looking for something new within the realm of remote-control aircraft, you'll want to read on. As its name implies, the X-Vert is a VTOL (vertical takeoff and landing) airship with quite a few additional capabilities. The model not only can take off and land vertically but also can fly like a multirotor or as a sport plane. Transitioning between the two flight modes is simple because the onboard flight controller that performs this task does so with the flip of a switch. The airframe itself is constructed from EPO foam and has a few plastic parts. I tested the BNF (bind-and-fly) Basic version, which, along with the one-piece airframe, gives you propellers, prop guards, winglets, and all the required electronics. The model arrives as an all-white wing with four large decal sheets included, so you can identify your X-Vert with several customizable color schemes. Whether you prefer a military look or an aerobatic design, you are covered. The well-written instruction manual is multilingual and includes all necessary information, from preflight to postflight, with plenty of photos. If you have flown multirotors but not airplanes (or vice versa), the X-Vert could very well be your bridge between the two. Perfect for an intermediate pilot, this aircraft could as well be handled by a beginner who has some RC experience.



AT A GLANCE	
	MODEL X-Vert VTOL
	MANUFACTURER E-flite (e-fliterc.com)
	DISTRIBUTOR Horizon Hobby (horizonhobby.com)
	WINGSPAN 19.85 in.
	PILOT SKILL LEVEL Intermediate
	ASSEMBLY TIME 5 to 10 min.
	RADIO REQ'D 6-channel
	POWER REQ'D 2S 800mAh LiPo
	PRICE \$149.99 (BNF basic); \$199.99 (RTF)
WHAT WE LIKE	
<ul style="list-style-type: none"> Open the box and fly in minutes Automatic transitioning Fully customizable FPV capable 	

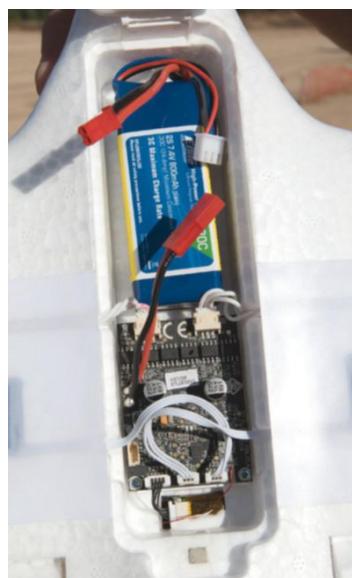




IN THIS GENERATION OF INSTANT GRATIFICATION, THE X-VERT EASILY FITS THE BILL AND DOES THE TRICK. DECIDING ON WHICH DECALS TO USE AND WHERE TO ADD THEM IS THE HARDEST PART OF ASSEMBLY. IT ONLY TAKES ABOUT FIVE OR SO MINUTES TO HAVE THE PLANE OUT OF THE BOX AND READY TO FLY.



Above: Props, guards, and propulsion systems are all included and provide plenty of thrust. **Right:** The "heart" of the X-Vert is preprogrammed for super-fun, exciting flights; the recommended battery fits perfectly.



UNIQUE FEATURES

A low-part count means that there is little to do when you open the box. Get your 2-cell 450–800mAh LiPo pack on a charger quickly because the X-Vert will be ready to fly in no time. While your flight pack tops off, you can add any mix of the included decals, your own favorite decals, or apply an original paint scheme. EPO foam is easily decorated with Sharpie markers with minimal weight gain, and I have also used water-based paint sprayed from "rattle cans" with great results. The brushless motors and counter-rotating propellers are preinstalled, but the prop guards are optional. Four screws are provided for securing them to their nacelles, and I recommend using them.

The wingtip/landing gear pieces are easy to attach. They are optional but are required for VTOL operations. The double-beveled



Left: The winglets are optional and are easy to install and remove. I recommend using them, especially for VTOL operation. **Right:** Motor cooling holes are molded into the airframe at the factory.

control-surface hinging was created during the foam-molding process and is sometimes called "live hinging." Simple and adjustable wire control rods are already added and connected to the two tiny rotary servos. All motor and servo wiring is cleanly concealed under white tape, which was also added at the factory.

A hinged belly pan is held closed with magnets and, when opened, reveals E-flite's all-in-one receiver/speed control/flight controller and

the flight-battery location. The hook side of hook-and-loop tape has been applied in the hatch area, and a mating piece is provided for your battery. A JST plug is presoldered to the electronic unit, and there is enough wire to easily reach the battery bay. Air holes are located on the bottom of the aircraft to help with cooling the electric components during flight. If you add decals over them, be sure to uncover these openings with a sharp hobby knife.

Options are always welcome, and the designers knew that some pilots would want to fly the X-Vert in first-person view (FPV), so there is an FPV camera mount available separately. The demo video shows that this new FPV mount will automatically transition with the



GEAR USED

RADIO

Spektrum DX18G2 (spektrumrc.com); E-flite receiver/flight controller/speed control unit and two 4g servos (all installed)

MOTORS

Two E-flite BL-280 2600Kv outrunners (installed)

BATTERY

E-flite 2S 800mAh 30C

PROPS

Two E-flite 5x3 (installed)

The VTOL Realm

Throughout history, designers have been trying to perfect a full-size aircraft that can take off and land vertically—with mixed results. Many ideas have come and gone within this aircraft genre, and VTOL has been traced back as far as the times of Leonardo da Vinci. Helicopters have had obvious success and an advantage over airplanes for a while but have demonstrated their limitations as well. Vertical takeoffs and landings are, of course, within a heli's capabilities, but their top speed and range are not exactly stellar. In addition, helicopters do not glide well, especially if power is lost. Having an airplane that doesn't require a runway to take off yet can fly for considerable distances at high speed must have sounded quite appealing to the military. The Lockheed XFY and the Convair XFY Pogo come to mind as airplanes we didn't see much of after their test flights. More time, technology and progress led to the Harrier jet family, of which the AV-8B (Harrier II) can reach a top speed of 673mph and has a range of 1,400 miles. And yes, it is fully VTOL-capable. The F-35B and V-22 Osprey are also obvious examples of successful VTOL airplanes that are not only currently active military aircraft but also often seen at airshows. I'm not sure how the pilots of those aircraft get their helmets on as I'm sure they know that they have some of the best "jobs" in the world.



aircraft, so whether you are in multirotor mode or airplane mode, your view will adjust for you in flight, allowing you to focus on flying. Should you ever have a hard landing or push the limit a little too far, repairs are easy. EPO foam fixes quickly with some CA, and there is a complete list of replacement parts available.

IN THE AIR

Here is where I typically tell you about how far an airplane rolls out or how much space is needed for a takeoff and landing. In the case of the X-Vert, along with its VTOL option on your side, you only need a 2-foot-square area to operate from. The model was tested in a small living room, at a club field, from grass, and from pavement. While in multirotor mode, the aircraft simply lifts off effortlessly and holds its place well, almost hovering itself. Punch-out power is excellent, and this translates to a quick top speed when you transition to airplane mode. Transitioning is done automatically as mentioned, and three flight modes will also help you in the air. Stability mode can be used during multirotor and airplane operations, and keeps you out of trouble. An AS3X Acro mode available during airplane flight allows some incredible stunts and

more intense flight maneuvering. While a vertical landing can be achieved from a hover, a hand catch or belly landing can also be performed. Be advised that wind will have some effect on the plane while in a hover, as the majority of the model's area will be exposed like a sail.

GENERAL FLIGHT PERFORMANCE

Stability: The preprogrammed stability mode features the SAFE (Sensor Assisted Flight Envelope) protocol and makes the X-Vert inherently stable. In a nutshell, the pitch and bank angles are limited, so you can't over control the aircraft while in SAFE mode. In Acro mode, you lose the stability aid and can then explore the plane's maneuver possibilities.

Tracking: Be sure to zero out your trims on the transmitter end and utilize mechanical adjustments to center your control surfaces.

When you get them close, only a click or two of trim should be needed and the plane will stay on track just fine.

Aerobatics: When you first watch the online video of the X-Vert, you will wonder how some of the maneuvers were performed. Thrust vectoring; excellent power output; and large, strong control surfaces allow for some real excitement and lots of fun in the air.

Glide and stall performance: With a super-sleek design and just a hair over 120 square inches of wing area, the glide slope is steeper than a trainer but not at all uncomfortable.

PILOT DEBRIEFING

Minimal time is needed to get your X-Vert flying. Transmitter setups are outlined in the instruction manual, and the factory programming provided is outstanding.

BOTTOM LINE

In this generation of instant gratification, the X-Vert easily fits the bill and does the trick. Deciding on which decals to use and where to add them is the hardest part of assembly. It only takes about five or so minutes to have the plane out of the box and ready to fly. A fully charged 450mAh battery offers about four to five minutes of flying time, while an 800mAh pack gave me seven to eight minutes. +

ESSENTIAL GOOD HABITS

Habits that hold a strong aerobatic foundation together

TEXT & ILLUSTRATIONS BY DAVID SCOTT

Over the past few months, I have been presenting various good-practice habits that foster faster rates of learning and proficiency. Indeed, I've been hearing from a number of my former students who think I've been "giving away the store." It is my view, however, that the whole sport benefits when people are more active as a result of flying becoming more enjoyable. Flying is, after all, a lot more fun when doing it well and making progress.

To recap, the solution to efficient practice and rapid advancement is consistency. Consistency is achieved through planning and learning to control the airplane proactively rather than merely react to it. That process starts with focusing on the basic execution and the types of control inputs required during each maneuver. By initially holding off on trying to correct deviations or add refinements, the plane will show you what needs to be added to prevent deviations and further refine each maneuver. The secret sauce is appreciating that "it's not how you start that counts, it's how you finish." Hence, when you input an incorrect amount, rather than trying to fix it and further complicating the maneuver for no gain, the wise thing to do is commit to it and try to learn from the mistake. This will enable you to quickly identify the correct inputs and thus develop the "muscle memory" motor skills that result in the maneuvers becoming nearly automatic. Reacting has its role, and by refraining from constant fiddling, you will achieve the necessary consistency to perceive the small touches that will then

enable you to perform the maneuvers nearly perfectly.

My intention this month is to round out this series by addressing two fundamental habits that must be maintained to become a proficient aerobatic pilot. They are: establishing wings level prior to entering each maneuver, and maintaining consistent positioning parallel to the runway centerline. Plus, I'll review a vital habit that has the potential to improve your flying beyond what you ever thought possible.

WINGS-LEVEL ENTRIES

A wings-level entry obviously ensures that the airplane will at least start out tracking vertically during looping maneuvers and prevent other maneuvers from initially veering off to one side. While I've addressed the importance of wings-level entries before, it is so crucial to overall success that it cannot be overstressed. I can tell you that roughly 10 percent of the effort expended during each of my four-day aerobatic courses is spent reinforcing the necessities of wings-level entries and proper positioning. Another

10 percent of the time I'm pointing out that the reason an attempt failed to go as planned was that one or both of those elements were neglected (that's with students driven to sign up for professional training, so you can imagine how common this fault is for the typical club pilot).

Ultimately, those who learn to prioritize wings-level entries and proper positioning prior to entering each maneuver avoid having to make a lot of corrections and, thus, use fewer "brain bytes" compared to those who loosely fly around. As a consequence, more attention can be paid to recognizing ways to further improve their maneuvers.

Conversely, if the wings are not level at entry, you could try to correct during the maneuver. Progress will inevitably ground to a crawl, however, as a result of exhausting most of your brain bytes fiddling with the ailerons (Figure 1). The resulting inconsistency would also make it nearly impossible to identify the plane's tendencies in order to rapidly improve the maneuver, or it may even cause you to misdiagnose your plane's tendencies. In short, like everything else in

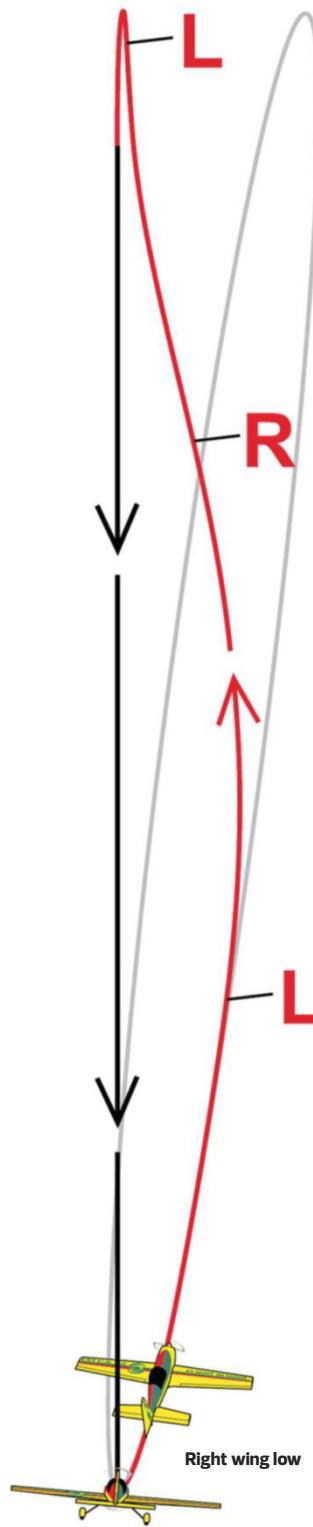
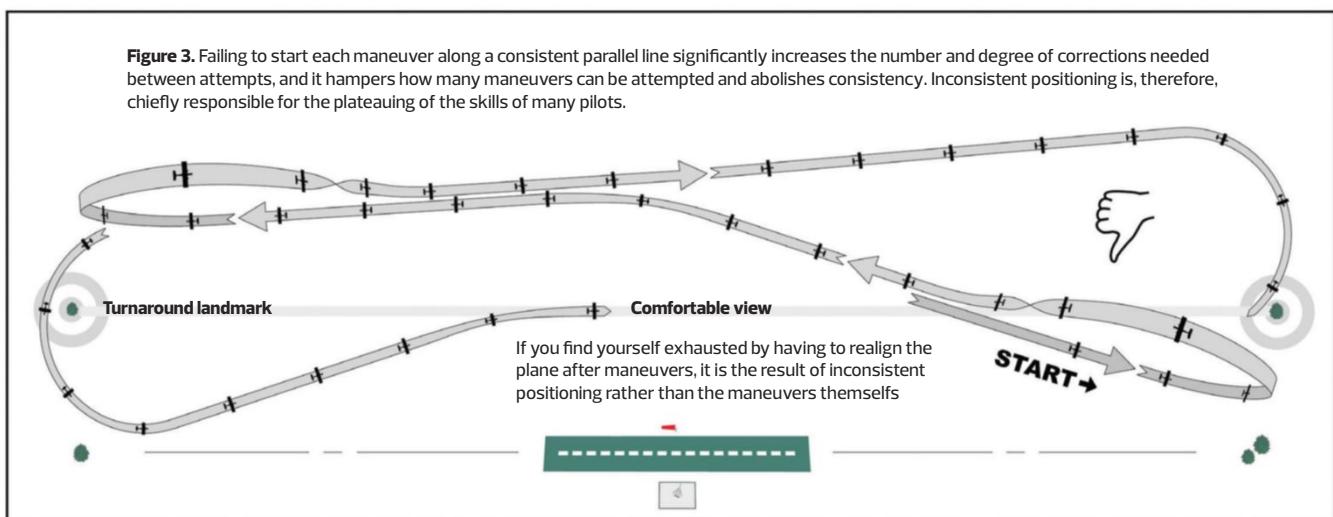
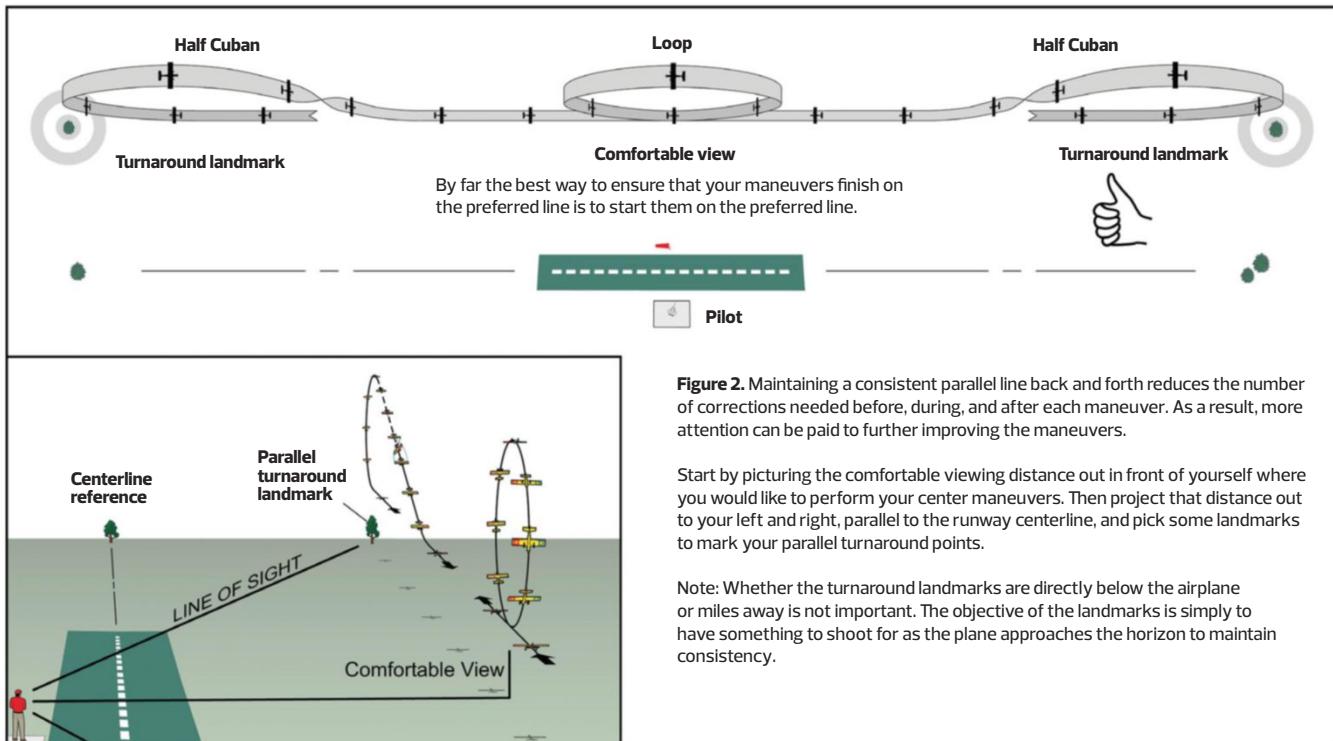


Figure 1.
Entering a loop without the wings level tilts the loop. Attempting to fix it puts the loop off-kilter and requires several additional adjustments to complete the loop on the original heading. In addition to greatly complicating the maneuver for little gain, the corrections tend to draw more attention than the original error, thus causing the loop to appear worse than if you would have simply performed a tilted loop. The solution is not to get better at fixing the deviation resulting from the wings not being level but, rather, to make certain that the wings are always level at entry.



life, it's far easier to do things the correct way and avoid problems than it is to try to correct them after the damage is done!

PARALLEL POSITIONING

Consistent positioning plays a supremely important role in how easily and rapidly pilots improve. In fact, it is so instrumental that you could even get away with entering a maneuver without the wings level (not that you'd want to), thanks to the wiggle room that proper positioning affords.

Consider this: If the plane is positioned correctly when a maneuver is begun, a pilot can actually afford to make a

mistake (e.g., input the wrong rudder) or encounter wind drift or turbulence and still complete it near the preferred path. Murphy's Law dictates, however, that if the plane is out of position and/or the wings are not level to start with, a pilot mistake or wind will quite often end up compounding the original flaw. It's a lot like when you become distracted while driving on a two-lane road and the car starts to veer. It's not a problem as long as the car was in the middle of the lane to start with. It's a different story if the car starts veering left when it was already hugging the centerline (i.e., has no margin for error). In short, the single most

important thing that you can do to ensure that each maneuver finishes on or close to the preferred flight path is to start the plane on the proper line to begin with (Figures 2 and 3).

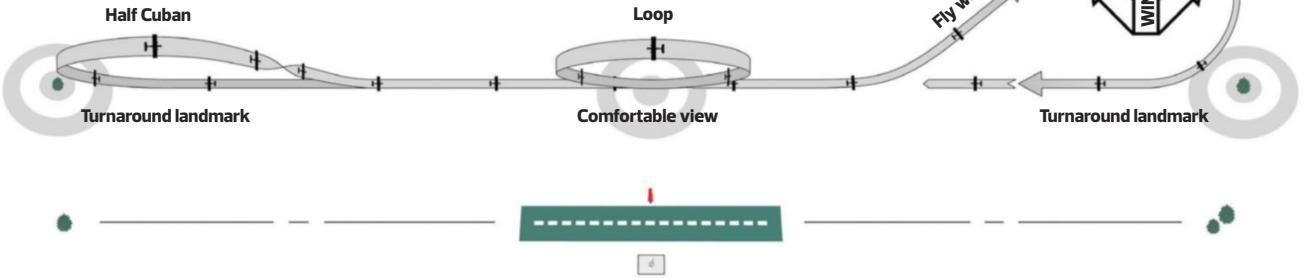
The first step is to walk out on the runway and survey your surroundings. Locate the landmarks in line with the extended centerline of the runway. Next, picture where you would like the airplane to pass out in front of you. With that as your starting point, visualize the plane's flight path back and forth parallel to the runway centerline. Then, identify some landmarks on the horizon in the areas

where you intend to perform your turnaround maneuvers (e.g., half Cubans, Immelmanns, hammerheads, etc.).

Once in the air, fly the airplane toward those landmarks, execute your turnaround maneuvers, and fly back to the same point in front of yourself. If you don't intend to perform an aerobatic turnaround, then, after the airplane passes out in front of you, fly wide of the parallel landmarks so that the subsequent turn will exit over the landmark and, thus, on a parallel track back out in front of you (Figure 4).

As a result of prioritizing positioning, fewer corrections will

Figure 4. If you don't intend to perform an aerobatic turnaround, fly wide (preferably downwind) of the parallel turnaround landmark and then turn back (into the wind) toward the landmark to exit the turn on a parallel line. Doing so increases the amount of time and distance after the turnaround to think about the next maneuver.



be needed between maneuvers. Consequently, the plane will seem like it's flying slower and, therefore, afford you more time to reflect on the last attempt, anticipate the next maneuver, receive instruction, introduce more maneuvers, anticipate wind corrections, or simply relax. Furthermore, since the principal effect of wind is that it tends to exaggerate deviations, wind won't seem to affect your flying nearly as much as it used to.

SITUATIONAL AWARENESS
By consistently performing the maneuvers along the same parallel line, the nuances common to each quickly become obvious, thereby enabling pilots to start anticipating the appropriate corrections (refinements). If positioning varies, however, the lack of a consistent perspective makes that almost impossible. Adding to the confusion, corrections that worked great during maneuvers attempted well wide of the runway centerline could end up causing the airplane to fly over your head when applied to maneuvers performed much closer. In the end, without positioning discipline, pilots inevitably resort to the progress-killing bad habit of constantly fiddling with the controls (whether needed or not) because no two attempts ever turn out the same.

When I'm instructing, my students will, from time to time, neglect to position and/or level the wings. After the subsequent poor or disorienting result, they'll sometimes claim to be having a hard time judging the plane's position, even though it was clearly not where it needed to be. The fact is that failing to maintain consistent

positioning occurs for the same reason pilots fail to level the wings prior to entering a maneuver: pilots get ahead of themselves or their attention is too divided and they, therefore, neglect to keep enough emphasis on it.

Knowing that every attempt out of position will likely prove to be a wasted effort or will reinforce negative habits, I utilize a small buzzer and step on it each time a maneuver is started out of position or without the wings level. As a result, my students become hyperfocused on making sure they position the plane over the proper landmarks and level the wings before entering each maneuver to avoid hearing the buzzer. And because of their buzzer-inspired heightened situational awareness, 99 percent of the time they are successful. Their practice is then so much more consistent and efficient that they start recognizing all sorts of ways that the maneuvers can be improved. (That's when we joke about having witnessed the miracle of instantaneous better eyesight.)

Another technique that I use in response to sloppy positioning is to wave a dollar bill in front of the student while he's flying and betting him that he can "hit his marks" for the rest of the flight; if he doesn't, he owes me a dollar. Of course, I lose the bet almost every time. But it's worth it when the number of inputs he has to make are subsequently cut in half, thus making things a whole lot easier on everybody. All this is to say that consistent positioning and wings-level entries are not difficult. It simply comes down to deciding to do it, and a lot of other things will

then fall into place.

SHAVE A LITTLE AT A TIME

As noted, consistently performing the maneuvers along the same parallel line and not having to fiddle with the ailerons thanks to level wings ensure consistent results and perspectives. Hence, even without trying, you will begin to identify the nuances (deviations) common to each maneuver, thereby enabling you to anticipate the appropriate corrections (refinements).

As I have been stressing for months, the initial objective when introducing refinements should be to under-control them. If you're going to err, under-controlling the input is always preferable to over-controlling. Remember, if you under-control the input, you will still have improved the maneuver (and have the option to add a little more); however, there's no going back when the input is too large and has already degraded the maneuver!

I have also been stressing that when a pro pilot under-controls a refinement, we prefer to leave it where it is rather than add more adjustments and risk drawing more attention to the error. Sometimes, however, the urge/need (such as during a competition flight) to input additional corrections is overpowering. In such cases, you will be wise to employ the full-scale technique known as "shaving." Rather than trying to fix the deviation all at once, gradually return the plane back to where it belongs a little at a time using small (ideally undetectable) corrections. (If you've driven on icy roads, you know very well the value of inputting several small adjustments to ensure a positive outcome versus using a single, more aggressive correction.)

Note: It takes a deliberate decision to learn this habit because you'll be fighting the natural tendency to keep increasing or reducing the size of the inputs until seeing something change. And as a result, you would end up having to fix your own fixes. Remember: When refinements are inputted correctly, there is often no indication that an input was made except for the fact the plane flew the proper path. Aiming to initially under-control your refinement inputs is paramount to achieving that objective.

FINAL THOUGHTS

Without understanding the benefits, those who consider themselves strictly sport aerobatic pilots might consider these habits to be too much work or require too much discipline. Yet the combination of consistent wings-level entries and parallel positioning doesn't just foster greater pilot proficiency, it makes flying more predictable and, therefore, less stressful. Indeed, if you're an older pilot and/or one who doesn't get to practice as much as you would like, these habits should be right up your alley. On top of that, wind won't seem to have much influence, trim and airplane setup changes will be easier to diagnose, and you'll have more leeway for when you make the inevitable mistakes. What more incentive would a ny pilot need to make positioning and wings-level entries your top priorities? Good luck. +

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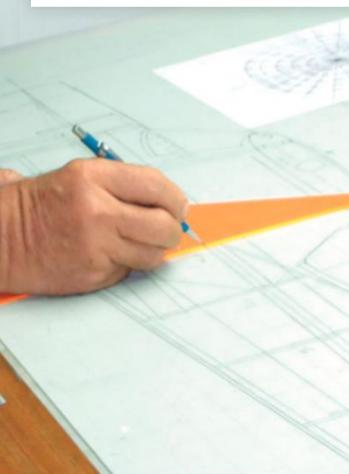


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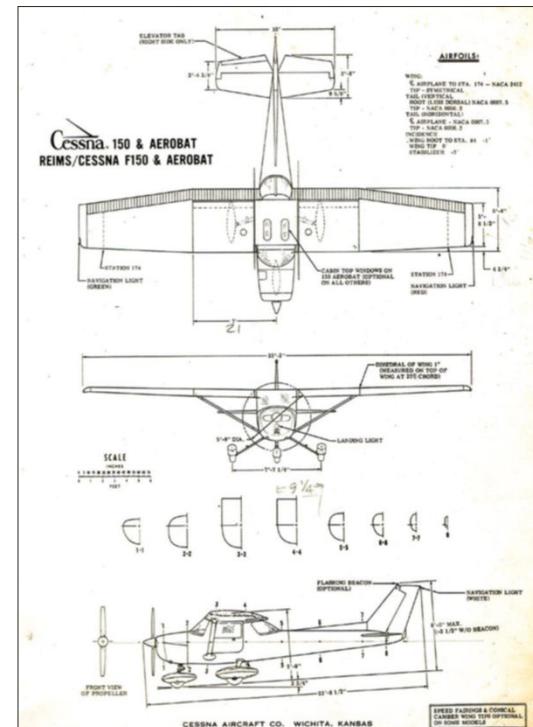


The master at his drawing table. Basic drawing tools and accurate enlarging techniques make any set of airplane plans possible.



Above: Nick's newest design: a Cessna 150/152.

Below: The first step is to find accurate three-view drawings on which to base your plans.



HOW TO

From Three-Views to Plans

THE BASICS OF PRODUCING ACCURATE RC DRAWINGS BY NICK ZIROLI SR. PHOTOS BY VINCE VELTRI & TOM SMITH

Over the past 75+ years of continuous model building, I've seen a lot of changes in our great hobby. RC technology has made great advances that, years ago, weren't even possible for any amount of money. This is all great, but what bothers me is the lack of originality on the flightline. Before ARF models became so popular, probably 90 percent of the pilots flew a model they had built from a kit or a set of plans. Now, it's just the opposite. I hope this article will help change the situation and reduce the ARF and quick-build trends.

It's gratifying to fly a model that you have designed and built yourself. But a prerequisite for designing a model is to have a basic knowledge of construction techniques. No secret here: You learn about this by building a few models from a kit or plans. Modeling magazines, including *MAN*, have been publishing construction plans for decades, and you can find a lot of them at AirAgeStore.com. Order a few sets of plans and study them to get a feel for what's required to build a model. As you start building, you may find ways of construction that you think may improve the design's structure or flight performance. Try them out, and don't worry about failure; rather, think of any setbacks as learning what doesn't work and not to repeat it.

WORK AREA

There are a few tools that are required if you want to create a model of your own design. First is a drawing board or surface. This can be a tabletop, small door, or piece of plywood at least long enough to fit the length of the fuselage you plan to build. Years ago, I acquired a 3 x 5-foot drawing table, and I've found that it is large enough for the models I was designing at the time. For really large models, like my 12-foot-span DC-3, I used a 36 x 80-inch hollow-core door on top of my drawing board.

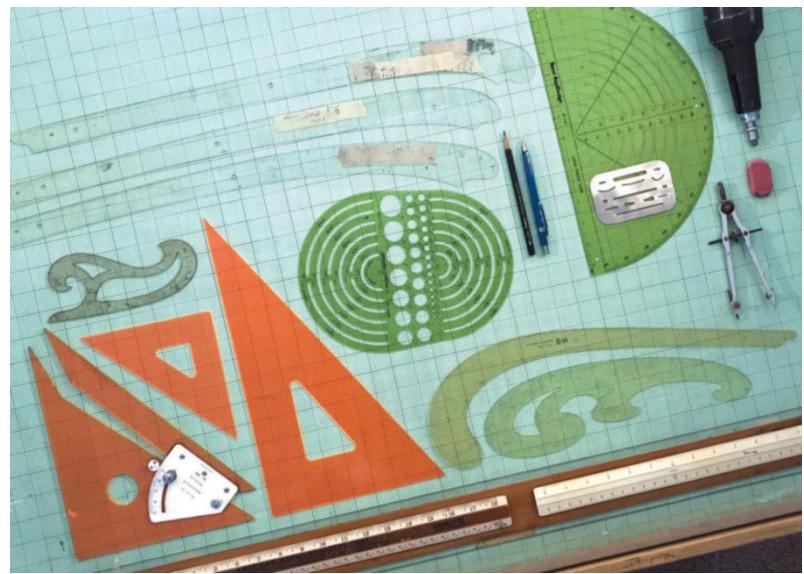
If you are going to draw on Mylar or drafting paper, a drawing-board cover sheet with 1/8-inch grid lines is a big help. These days, you can draw on plain paper and have copies made at many print/copy shops. In the old blueprint days, the light had to pass through the paper and clear the light-sensitive surface of the paper, leaving the pencil-line-sensitive areas of the drawing. A trip through ammonia vapor turned the sensitive areas blue or black, reproducing your drawing.

DRAWING TOOLS

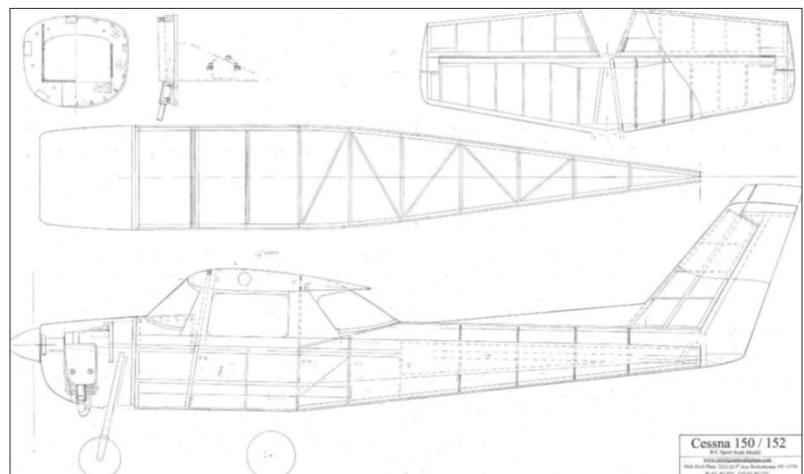
To do the job right, you will need some special tools. Drawing templates, French curves, and ship curves are necessary for drawing outlines, formers, and airfoils. Circles can be generated with some circle templates or an adjustable pencil compass. Most arts/crafts supply stores will have a selection of these curves. Also both a fractional and decimal scale (ruler) will be required. Mechanical pencils and large, flat erasers are also a must-have. A pencil sharpener and a drafting brush to clean off your plans are also good to have on hand. Really, any type of paper can be used, but large-format drafting paper is the best to use. Drafting crepe-paper tape is handy to keep the corners of your paper secured so that the paper doesn't move around.

LET'S GET STARTED

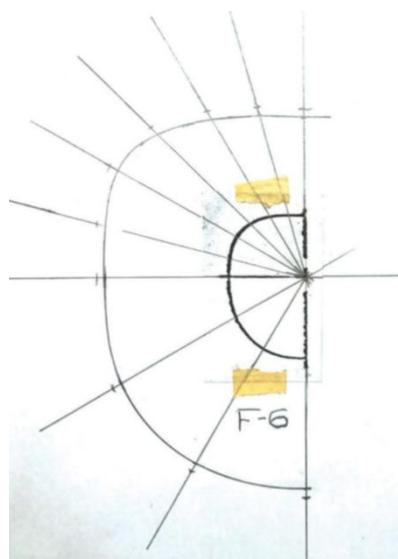
If you've read this far, you must have in mind an airplane to model. The first thing you need is a good three-view—the larger, the better. It's also important that your three-view drawing have some fuselage cross-sections (formers) included. You can have it enlarged to your desired model size, or you can scale it up yourself; it isn't that difficult. Start by deciding how large a model you want. For most of my flying, I like giant scale, so for me, the span has to be at least 80 inches for a monoplane. To create our full-size model plans, we are simply going to enlarge our three-view drawings to the size model we want. We are just drawing the enlarged size outline.



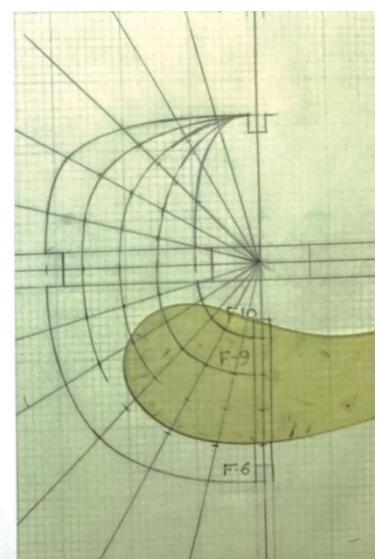
Here are Nick's basic drawing tools. A lot of his plans were drawn with these.



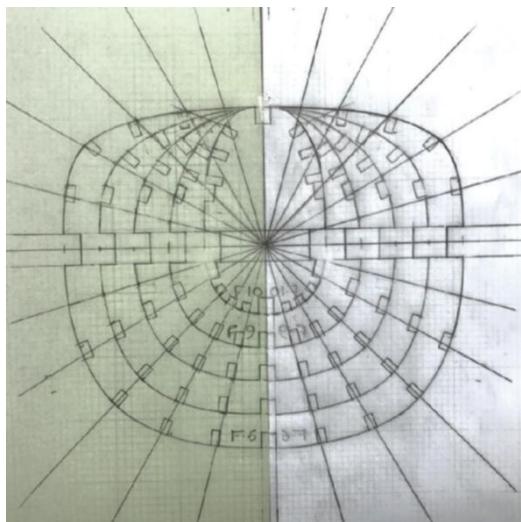
This is an early version of the Cessna plans, showing the fuselage side and top views along with the stabilizer and firewall details.



Here is how Nick enlarges the basic shape of the three-view cross-sections to produce the shape of the formers. Check the text for details.



HOW TO FROM THREE-VIEWS TO PLANS



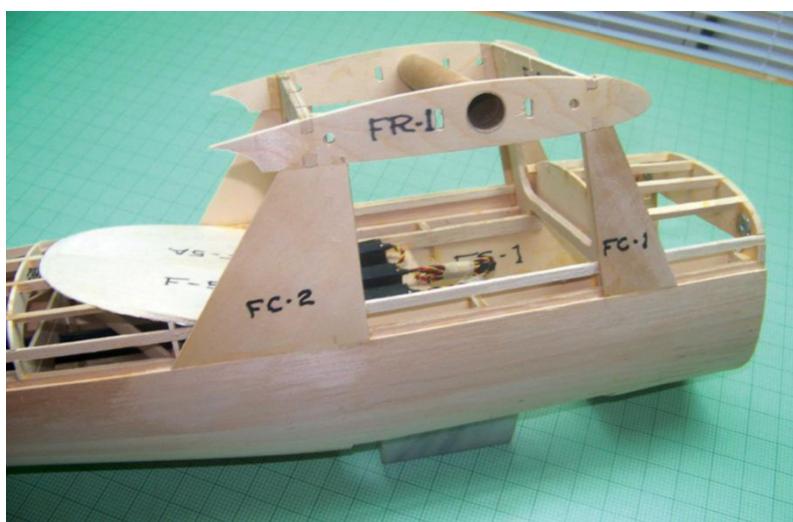
Drawing all the formers as viewed from the tail of the airplane is a good way to check for any mistakes.



All of Nick's airplane designs use this basic fuselage crutch to keep the formers in proper alignment and position.



Here the fuselage is beginning to take shape. Any misalignments that arise at this stage are corrected on the plans.



This shows the fuselage with the sheeting being installed.

RUNNING THE NUMBERS

Here is how I go about it; we'll use my current project, a Cessna 150, for some examples. The full-size Cessna 150 has a 33-foot 2-inch wingspan. Convert the span to inches by multiplying the wingspan by 12. This gives you a 398-inch span. To determine the scale of your model airplane, divide the 398-inch span by the desired 80-inch model span. You'll come up with a figure of 4.975, which is very close to a factor of 5, or 1/5 scale. This size gives us a 79.6-inch span for a 1/5-scale model, and using the 4.975 factor, the model is exactly 80 inches in span. If you want a model with an 81-inch span (my ultimate choice for scale size), the factor is 4.913. This turns out to be a good-size model. Three-inch nose-gear wheels and 3 1/2-inch main wheels are very close to scale. A 2 1/2-inch spinner and 1/5-scale pilot bust also fit nicely.

From here, I enlarged my small three-view drawing to a 15-inch wingspan. When we divide 81 by 15, we get a multiplier factor of 5.4 to draw my new plans.

Here's where a good decimal scale is required. For the math, simply set up your calculator with a 5.4 constant and multiply every dimension you take from the 15-inch-span three-view drawing by 5.4 and transfer it to the full-size plan. All the dimensions are multiplied by your multiplier except for the angles (these won't change regardless of scale or size).

ANGLES

When working with angles, a good number to know is 0.0175 inch. This is the 1-degree height, or rise, of a 1-inch line. The Cessna root rib incidence is indicated as 1.5 degrees positive. So we take the chord length, which is 13.5 inches, and multiply by 0.0175. This gives us 0.23625. Multiply this by 1.5 degrees and we get 0.354 inch, or just under 3/8 inch for the incidence. This is very handy when you know an angle, like dihedral, and have to figure out the dimension at the wingtip.

If your three-view drawing does not have a fuselage centerline, add one to it. The prop shaft at the nose is usually a good location. Measure down from the front of the engine shaft to the bottom edge of the drawing. Assuming that the fuselage was drawn parallel to the bottom edge, use this dimension at the tail and draw the line accordingly. The centerline is usually indicated on the fuselage cross-sections as well. Measure from the centerline to the top and bottom of the cross-section outline, multiply these dimensions by your multiplier factor of 5.4, and transfer the results to your model drawing to determine the size of the full-size cross-section. The top view of the fuselage is treated in the same way, measuring from the centerline outboard to each side.

FORMERS

Most civilian aircraft (the Cessna 150 included) have many straight lines in their side and top views. Generally speaking, from the trailing edge of the wing to the tail post, most formers are straight. This makes plotting formers and stringer locations much easier. For measuring accuracy, I enlarge the reference formers more than the outline views. In this case, the multiplier was 2.72. Draw the forward former and then the aft one inside it, locating both on the vertical centerline. Locate and draw the desired former locations between these two on the side and top views, placing one at the leading edge of the stabilizer. Measure from the centerline to the top, bottom, and sides, and mark on the former sheet you are creating. With a 30/60-degree triangle, draw a line every 30 degrees out from the centerline on both your three-view and your new drawing. Add a line between each 30-degree section to make sections 15 degrees wide. Now measure from the three-view centerline to the edge of the section, multiply by 2.72, and mark that line on your plan drawing. Repeat this with each line. Using an appropriately sized curve, join the marks to make your model's full-size former. The more complicated the shape, the more lines and measurements are needed.

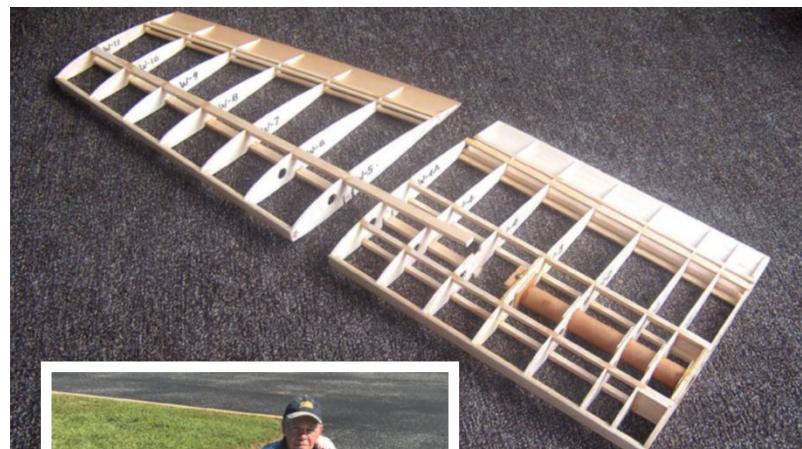
FLYING SURFACES

Wings and most tail surfaces are relatively easy to enlarge. The only ones I would consider having enlarged from a three-view would be an elliptical shape, such those on as a P-47 or Spitfire and some tail surfaces. Even these can be enlarged, like the formers, by starting with a reference line drawn down the main spar or hinge line. Draw the rib locations and other lines if required. Measure your three-view fore and aft of the reference line, and connect the dots with your drawing curve.

For an 80-inch wing, I space the ribs 3 to 3 1/2 inches apart. My choice for airfoils has always been the NACA 2410 to 2412. The "10" and "12" indicate the percentage of chord thickness of the wing. Washout at the wingtips is very important. I set the wing incidence at positive 1.5 to 2 degrees at the fuselage and 0 degrees at the tip rib. Over the years, this has worked well for me. For the Cessna's wing, a straight 1/4-inch strip (under the trailing edge) running from the first outer-panel rib to the wingtip shims the ribs to set the 0 degrees for root rib and 2 degrees negative at the wingtip (trailing edge up). Depending on how scale you want your model to be, the tail surfaces can be simple flat plates or drawn with a symmetrical airfoil; either way works well.

For good flight performance, I like to set the stabilizer incidence at 1 degree positive, (leading edge up). All of the wing and tail incidence as well as the engine thrust angles are referenced to the centerline of the fuselage. For each rib, a reference line should be drawn from the most forward point of the leading edge to the rear tip of the trailing edge.

As a rule, our plans' top, side, and front views (formers) are just enlarged outlines taken from our three-view drawing. We have to draw the new outlines full size before we can add all the internal details that make up the plans. We do this working from the outside and working inward. First, draw in the thickness of the wing and fuselage sheeting, usually 3/32 to 1/8 inch. Then, for the wing and tail surfaces, we add the cross-sections for the main and secondary spars and other structures. For the fuselage, we add the stringers and longerons that will support the outer sheeting. We then add the leading and trailing edges and build up the structures around the hinge lines and



Above: Here, the wing inboard and outboard panels are taking shape.

Left: Nick shows off the completed Cessna. He chose the USAF Academy's Cessna T-51 trainer scheme—so, yes, this is a warbird.

Below: Using Nick's standard wing and tail incidence settings, the T-51 flew great right from the start. A Zenoah G-23 is an ideal engine for this 80-inch Cessna.



other hardware attachment points, such as the landing gear, engine mounts/firewalls, and wing saddles.

Experience is required here to determine the wood sizes. The best way to gain this experience is to actually build a model or two from kits. You can also ask friends who are model builders and look at plans for other similarly sized models to determine the recommended dimensions. For my 80- to 110-inch-span models, I use 1/8-inch-thick poplar plywood for formers, internal plates, and wing saddles. Most stringers are 1/8 x 1/4-inch and sometimes 3/8-inch hard balsa. Hardwood can be used along the edges of open areas, such as hatches and gear doors. Fuselage and nacelles multi-engine models are usually sheeted with 1/8-inch balsa. This provides enough thickness to allow adequate sanding where glue joints and seams are not perfect.

FINAL THOUGHTS

As with anything new, start slowly and work your way up. Pick a relatively simple airplane with lots of straight lines and simple curves. A Pietenpol and Taylorcraft come to mind as excellent first tries. Take your time, and have fun. This is the other part of our hobby, which is just as important as the flying part. †

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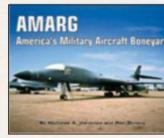
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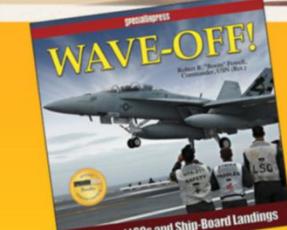
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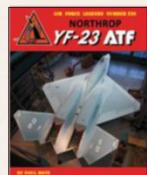
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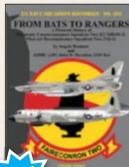
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From Dennymites to Four-Stroke and More!

[Q&A]

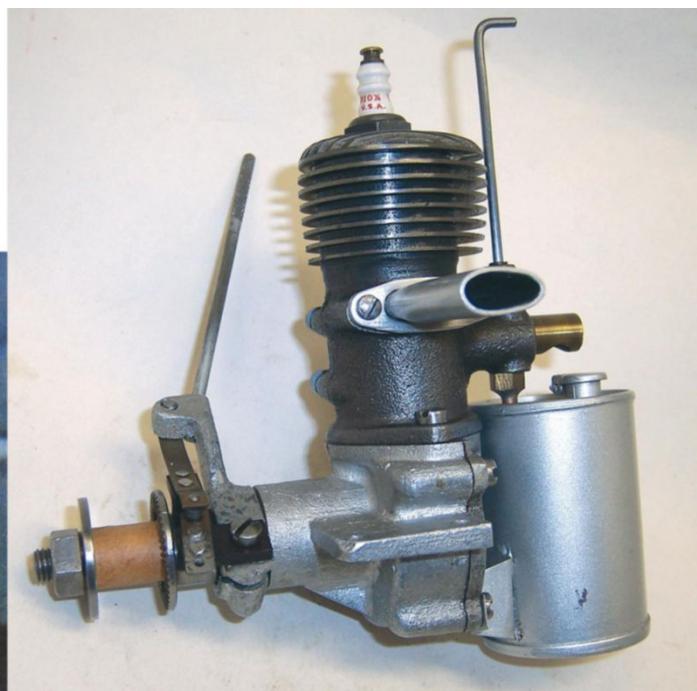
Email your questions to Clarence Lee at MAN@airage.com.

As I have mentioned several times in the past, more and more readers have been asking for sources for parts or identification of an old-time engine they have obtained. Such is our first letter this month. I imagine that this can be attributed to the swing to electric power rather than internal-combustion engines, which seem to be dying a slow death judging by the number of engine manufacturers that have closed their doors. Our first letter is typical of ones that we have received lately.



Radioplane Company employee Norma Jean Baker later became known as Marilyn Monroe.

The 1938 Dennymite Airstream (later called the "Tin Can model" by engine collectors) was a popular free-flight and tether race-car engine prior to WW II. The first ad for it appeared in the July 1938 issue of MAN.



DENNYMITE TALES

I have a small collection of older spark-ignition engines that include an O&R 60 and 23, Super Cyclone, and McCoy 60. However, I recently visited a yard sale and bought a beat-up control-line airplane with a motor that says "Dennymite" on the plate on the side of the engine, opposite the exhaust. I have never heard of this engine and wonder if you can tell me anything about it.

—Ken Wallace, Hawthorne, NV

Answer: Yes I can, Ken. The Dennymite was a very popular free-flight engine back prior to WW II due to its light weight and power output. A lot of fellows also used it in tether car racing. A famous British Hollywood actor named Reginald Denny had been a modeler in his younger years and opened a hobby shop



on Hollywood Boulevard in Hollywood, California, in the mid-1930s. (The Hollywood Freeway now passes through where the shop once stood.) Denny decided to add an engine to his line of products and started looking for someone to manufacture it. One stipulation was that the engine had to run continuously for 50 hours—something full-size aircraft engine had to do for licensing. Several people submitted designs, but Walter Righter's design was chosen and given the name "Dennymite." It was later named the "Dennymite Airstream," due to the teardrop-shaped cylinder. The engine had a displacement of .57ci and appeared in 1937. Production continued until 1945, when the company was sold to Pacific Aeromotive Corp. in Burbank, California. The displacement was raised to .5588ci; it was given a round cylinder, and the name was changed to the "Meteor 60." Then, in 1948, production rights were sold to Ohlsson & Rice (O&R) who went back to the original .57-size engine with the teardrop cylinder and "Airstream" name. Whether O&R did not receive the rights to the Meteor engine and name I do not know, but I assume it must have received a large inventory of the original Airstream parts.

During WW II, Walter Righter manufactured a 45.6ci, 20hp, horizontally opposed twin for RC target drone aircraft. Along with Reginald Denny, he and a man named Whitley Collins (the main financial contributor along with some other investors) formed the Radioplane Co. to build RC drone aircraft. One of their employees was a young lady named Norma Jean Baker, who later became Marilyn Monroe, the movie actress. A little side note: In the mid-1950s while making my Lee 45s, my wife had a friend named Fran Tucker. When Fran found out I was making model engines, she told my wife that her dad had also made model engines. Guess who that was? Walter Righter. She also went on to say that, as a small child, she used to sit on a stool next to her dad and watch him assemble engines. When she got a little older, she also started assembling engines until WW II, when model engine production was put on hold.

The O.S. 120 Surpass II lever-operated idle and midrange mixture control carburetor was exclusive to the 120S II and was not used on later models.



UNDER PRESSURE

✉ I'm wondering if you could help me with some clarification of an article that appeared in a July 2009 *MAN Engine Clinic*. I saved this particular article when I purchased an O.S. 120 Surpass III pumped engine around that same time. I'm finally getting around to installing the new-in-box engine in a project this spring, and I want to be prepared to adjust the engine if necessary. Your "Tip of the Month" described an alternate technique to tweak the pump pressure if it ran rich at idle and through the midrange due to the pump supplying too much pressure. You described a technique to adjust the full mixture on the 1.20's carb by "removing the idle mixture adjustment screw and manually moving the notched mixture lever slightly leaner." Here are my questions. Is "notched mixture lever" in reference to the throttle arm? Does "slightly leaner" mean in a direction that opens the venturi slightly to allow more air into the mixture? I've occasionally had a similar problem with a pumped O.S. .91, so when I rediscovered this article packed into the 120's box, I considered trying the same adjustment with that engine. Thanks in advance for any information you can supply.

—Jim McCoy, via email

Answer: Jim, I'm afraid you made a mistake in assuming that the O.S. 120 III used the same carburetor as the 120 II; it does not. They use two entirely different carburetors, with different methods of adjusting the idle and midrange mixtures, as pointed out in the article. The 120 II uses an eccentric screw that moves a lever with limited movement. Removing the eccentric screw allows the lever to be manually moved farther. Clockwise leans the mixture and counterclockwise richens.

FOUR-STROKE BLUES

Our next letter is actually a two-parter: the writer Bob Davis's original letter (and my reply) and Bob's follow-up.

✉ I have a new Thunder Tiger 75 four-stroke that's driving me crazy. I have it installed upright on a Phaeton II biplane—and it isn't my first rodeo with operating four-stroke engines. My problem is a lack of power. I can only get a reliable high end of 7900rpm using a 13x6 Master Airscrew prop. A 12x6 only yielded an increase of about 300rpm. I've tried different glow plugs to include an F and Thunderbolt four-stroke plug, checked and adjusted the valves after break-in, and checked the valve spring tension. Compression is great: It starts easily, idles reliably, and runs smoothly. It just won't "wind up" to the advertised 10,000 or so rpm. I tried running it on a test stand to ensure this wasn't a fuel

ENGINE CLINIC

BREAKING NEWS



While working on this month's column, I received word that Frank Bowman, who has been making aftermarket piston rings for 37 years, has decided to retire. I have always found Frank's rings to be equal to or better than original factory rings, especially some of those coming from China. However, we have good news as Frank has sold his business to a fellow named Bjorn Baal, and since the first of the year, he has been training Bjorn on the art of making rings using his Logan lathe, which he also sold to Bjorn. Frank is still serving as an adviser if Bjorn has any questions. Frank has always had rings available for just about any make of engine, and if not, he would make them if you sent him the engine's piston and sleeve. I am assuming that Bjorn will be doing likewise. You can contact Bjorn at rmjmachineworx@gmail.com or 505-716-7289.

delivery problem but had no improvement on the top end. I'm using Wildcat 15% nitro with 20% oil and castor. I'm curious if it's possibly a timing issue, although I've removed the cam cover and the timing mark aligns with the pushrods as per the instruction manual. Perhaps it was mismanufactured? I read and enjoy your column monthly and recall one that addressed "valve float" but really doubt this is the issue since it's a brand-new engine. I would appreciate any advice you might have to offer.

—Bob Davis, Volunteer Aeromodelers, Knoxville, TN

Answer: Bob, you sure have a puzzle that I am not sure I have an answer for. The only thing I can come up with is the cam timing is off, as you suspected. Remove the rocker-arm covers and, with the piston at top dead center on the over-lap stroke (i.e., when both valves are partially open), lay a small ruler across the rocker arms. It should be approximately level or just a hair off. If not, the punch mark has been punched in the wrong place. I would appreciate hearing what you find.

Response: Mr. Lee, I did the troubleshooting suggested in your email, and sure enough, at TDC on the over-lap stroke, the valves were askew about 10 degrees. I reset the cam gear so that the valves were level at TDC and reassembled the head. I ran the engine on the aircraft and got a slightly rich-running rpm of 9700. Bottom line—the timing was the issue. The factory punch mark on this engine is now a 12:00 instead of 1:00 as it came out of the box. I'm surprised it ran so well "mistimed"; the only indication of a problem was the low output. Many thanks for your Engine Clinic column and sound advice. I've read your column religiously for many years and, after reading your email, remembered you had offered this technique/procedure for timing a four-stroke in one of your previous columns. Age is taking a toll on my memory!—Bob Davis

Reply: Thanks for the follow-up, Bob. Evidently the instructions should have read "straight up" rather than aligning with the pushrods. Thunder Tiger four-stroke owners, take note!

GAS-ENGINE ADJUSTMENT

✉ Being disgusted with glow engines due to their unreliability, I decided to switch to more reliable gas engines. I completed an older Carl Goldberg Ultimate 10-300 model and installed a brand-new Evolution 15cc gas engine. It started well, and I broke it in according to the manufacturer's instructions and specified fuel mix. The first flight went amazingly well until the landing. I couldn't get the plane down on the runway as I had set the idle a little too high (I had assumed that a biplane would have more drag and

slow down faster). On the third or fourth attempt, the engine abruptly quit, and the plane cartwheeled down the runway. The repairs took me a few weeks and then I was off again. The plane flies like the proverbial homesick angel, and I was having a great time—and then the engine stopped dead again (in level flight) and the plane went straight down into a swamp. After a couple of days of hunting, we eventually found the plane, and miraculously, there wasn't a mark on it. The engine was a bit wet, and the bulrushes had cushioned its fall. We put the plane back on the bench, dried out the engine, and fired it up. It ran perfectly for more than 30 minutes, still on the same tank of fuel. I had some discussions with the folks at Evolution, and all they could suggest was opening up the needle a couple of clicks. I am afraid to fly this plane again as I feel I cannot trust this engine, and when the power goes out on this airplane, it glides like a rock!

—Dick Parkes, Kamloops, BC, Canada



Like other gas engines, the Evolution 15cc powerplant may require a richer mixture than the manufacturer recommends.

Answer: Dick, gasoline engines are far more critical in their mixture-adjustment range than glow engines. You were probably just setting the engine too lean and should have used a richer mixture than the fellows at Evolution told you. You also say that you dried the engine off and flew it again and that it ran OK on the same tank of fuel. Even so, I would be suspicious of water having gotten into the fuel. Try using some fresh fuel and setting the engine richer.

COMPRESSION ISSUES

✉ I have an older Super Tigre 51 that had only been run for a few minutes years ago, then loaded with after-run oil and stored away. I have a building project in mind that calls for an engine this size. Yesterday morning, I gave the engine some short 30-second runs. Initially, the cold compression was good but after the running is now very low. The engine uses piston rings. Any idea why the compression would drop like this when cold?

—Dirk Dedeos, Fountain Valley, CA

Answer: Dirk, several things come to mind. Did you check the head screws for tightness? This should always be done when a new engine has been run for the first time. The aluminum head and cylinder expand, stretching the steel screws, resulting in the head loosening. The same thing should be done following an excessively lean run. When you say it is an older engine, how old is it? The past couple of years, Super Tigre engines have been made in China. I get quite a few letters complaining about the soft compression, which usually gets better after the engine has seen some running time and the rings are seated; this might be what's causing the problem. Also, after the engine has been out of use for a while, the after-run oil may have congealed or thickened, sealing the compression. After running, the thicker oil will be flushed away. I would be willing to bet that after getting more running and air time, the rings will seat and the compression will improve.

That does it for this month, gang. We'll be back in the February 2018 issue, beginning the 49th year of writing the column. +

LET'S TALK GIANT SCALE

TEXT & PHOTOS BY JOHN GLEZELLIS



The correct engine choice will result in a satisfactory flight experience for all pilots. Here, the Handley Page Type E awaits another flight with a newly installed Zenoah G-38.

Choosing the Right Engine for Your Airframe

During the construction of a giant-scale model, many decisions must be made that will dictate the performance of the aircraft. While it is important to follow proper build and installation techniques, you must also select the right components to ensure success. The experienced builder understands, for example, that an underpowered model can become quite unpleasant to fly and that engines are the main factor in either satisfactory or marginal performance.

In my current fleet, I have a scratch-built 111-inch-span Handley Page Type E monoplane that was originally powered by a Zenoah G-26 engine turning a 16x8 2-blade propeller. During its first flights in Boston during the winter, it had rather scale flight characteristics. Maximum power was required for the takeoff, and a fair amount of power was needed for traditional horizontal flight. When I flew the same model during the summer in high humidity, 90-degree temperatures, and 15mph winds, it was clear that more power was required. The first step was to try different propeller styles, sizes, and pitch amounts. Starting with the factory-recommended 16x8 as a base, I tried a few different diameters and pitch amounts as well as props of the same diameter and pitch

from different manufacturers since performance differs from one brand to another. No matter what propeller I used, performance still suffered and full throttle was needed for a majority of the flight, leaving no room for error. For a more enjoyable experience under a variety of weather conditions, it was time to select a more powerful engine.

In this column, we will touch upon a few engine-selection fundamentals and how you can modify an airframe to accommodate a different engine.

POWER SELECTION BASICS

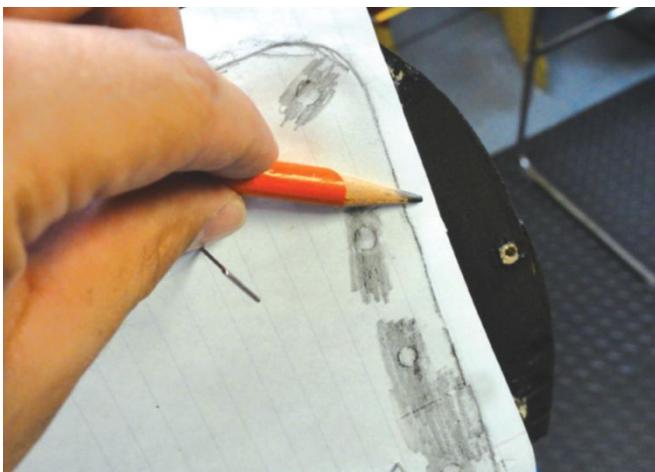
The general rule in selecting the right engine is to not exceed 12 pounds of aircraft weight for every one cubic inch of engine displacement. The

Zenoah G-26 has 1.55 cubic inches, so the 2.3ci G-38 obviously offers more power and would be sufficient for the Type E monoplane. After looking at a few different engine options that would fit within the cowl of the Handley Page, I opted to use the Zenoah G-38 because it's reliable, it has a magneto-driven CDI for simpler operation, and the model needed additional nose weight anyway. I also have a G-38 in another model, so I already have a spare G-38 carburetor rebuild kit and various G-38 engine bolts in my toolkit that I bring to the flying field. Using engines that are the same—or at least that use similar parts—greatly simplifies the process when I'm in need of a specific part.

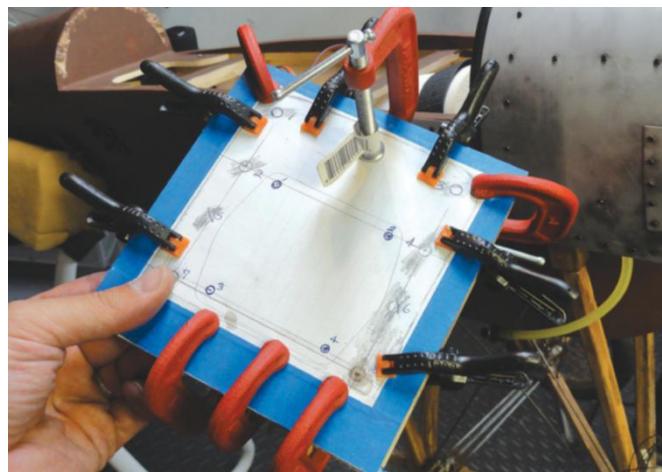
ENGINE INSTALLATION 101

When examining an aircraft, pay particular attention to the firewall and alignment relative to all other formers. It is common for an airplane to feature right thrust built into the firewall, so the engine may not be centered within the firewall and offset of a slight amount allows the shaft of the engine to be centered within the cowl.

It is important to analyze the material used for the firewall. Zenoah recommends that the G-38



To accurately transfer the original bolt pattern to the firewall adapter plate, simply rub a pencil over each bolt location and mark the center of each hole.



Use of clamps during any bonding procedure is mandatory for proper alignment. In this photo, you can also see the original mounting-hole pattern as well as the new pattern for the G-38 engine mount.

be secured to a firewall that is at least 10mm thick using four bolts. The firewall for Handley Page has 3/8-inch plywood interlocked between two spruce stringers and an additional 1/4-inch reinforcement bulkhead. To bring the engine to the appropriate distance, I made spacers out of plywood that were oversize along the perimeter compared to the metal engine mount plate. I epoxied each plywood layer together to obtain the proper distance. Since the G-38 has a different bolt-mounting pattern, I made a 1/4-inch firewall adapter plate. (I did not want to attempt to drill through the spacers that were already glued together due to the length of the completed assembly; I would have needed 3-inch bolts to secure the engine, and it would be difficult to hand-drill four mounting holes a distance of 3 inches and keep proper alignment.) My firewall adapter plate has holes that match the original bolt pattern for the G-26 as well as the G-38. I secured the G-38 into position with the head of the bolt facing the rear of the aircraft since the engine mount is threaded. This entire assembly can then be bolted to the airframe using the same bolt pattern that was used to secure the G-26 in place. Let's move on to see how I made this plate.

I began the process by laminating two slightly oversize (compared to the plywood spacers) 1/8-inch aircraft plywood pieces together with Zap 30-minute epoxy. Clamps held the pieces in place until the adhesive cured. I then made a hole position and spacer template using a sheet of 8 1/2 x 11-inch paper. I pinned the sheet in place over the original firewall and rubbed a pencil over the surface near each mounting hole as well as over the corners of the original spacers. In this case, I found five holes. I drew lines from the center of each hole to the others to find the engine's horizontal and vertical centerlines. I then transferred the bolt pattern for the G-38 engine mount to this sheet and again found and marked the center of each mounting hole. I applied contact spray to the template to secure the sheet to the plywood adapter plate and then cut the plate with a scroll saw and perfected it with

a belt sander. I then drilled each hole, first with a 1/8-inch pilot hole, then enlarged it to accept each respective mounting bolt. Each of the five original mounting-bolt positions would now accept an 8-32 bolt as well as a G-38 mounting bolt. Since the head of each engine mounting bolt would contact the original engine spacer, I used a Dremel 1/4-inch, 60-grit sanding drum to ensure that the head of each bolt was recessed to allow proper contact between the adapter plate and the original engine adapter.

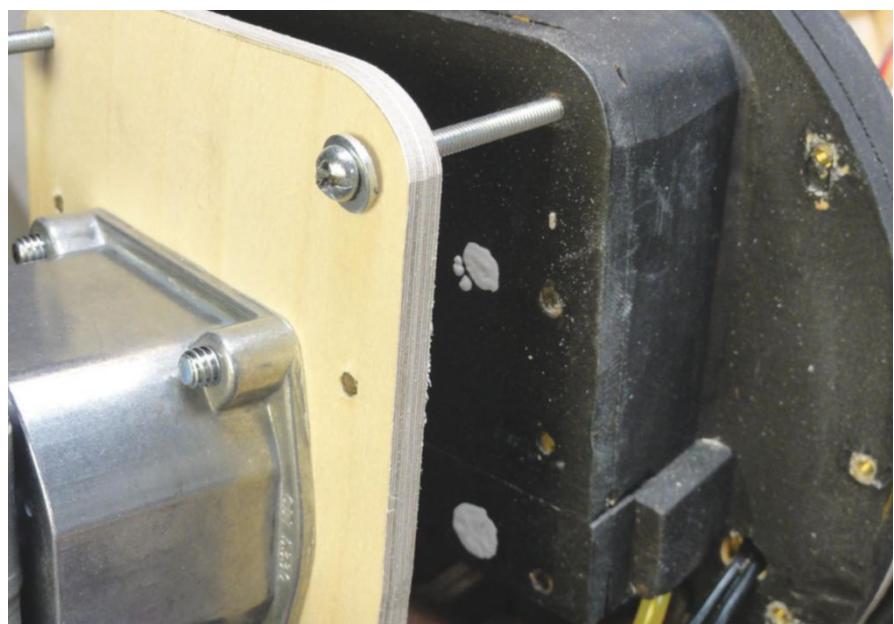
Depending on the length of the new engine, you may need to modify the airframe. When engine standoffs are used, one can simply order a standoff that is the proper length. The G-26 is 139mm in length, whereas the G-38 is 170mm. Either the back of the propeller will be spaced, at minimum, a distance of 31mm or (in this case) 37mm with the additional 1/4-inch adapter plate, or one will need to modify the plywood spacers to result in the same distance as

originally intended. If your aircraft uses standoff kits, like those available from SWB, you will simply need to transfer the new engine bolt pattern over the existing firewall. Existing mounting hole positions can be filled using hardwood dowels and secured using epoxy.

I bolted the firewall adapter plate in place using the five 8-32 x 3-inch bolts, washers, and locknuts. T-nuts can also be used, but I prefer locknuts since I have had poor-quality T-nuts fail in the past if they're overtightened. I secured the engine using the appropriate hardware and used thread-lock throughout wherever I didn't use locknuts. With the engine in place, it was time to install the throttle servo and all related linkage hardware.

LINKAGE SETUP

Before I could determine the proper location for the servo, I had to make an adapter that would bolt onto the throttle arm on the carburetor.

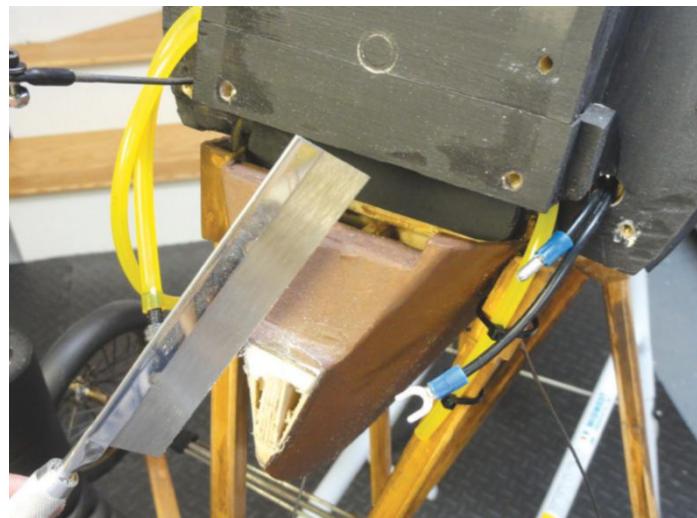
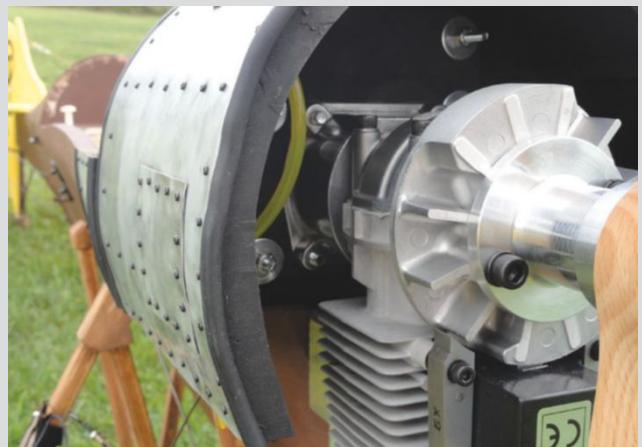


Due to the type of engine mount used, the engine bolts from the rear of the mount with four bolts. The adapter plate is then secured to the airframe using five 8-32 bolts.

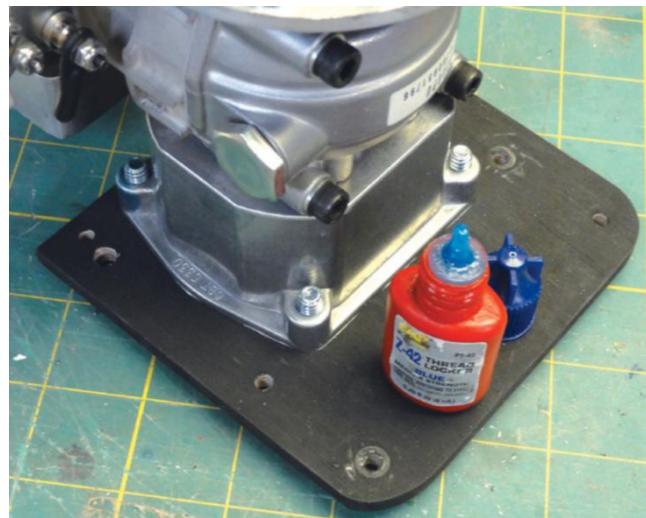
TIP OF THE MONTH

While the engine discussed this month does not contain an electronic ignition, you should always keep items like the fuel tank, fuel lines, and battery cables away from the ignition as well as areas where heat is generated by the engine and exhaust system.

Additionally, allow for proper cooling for the engine. The bottom of the cowl of the Handley Page Type E is fully exposed. On other models, allow in as much cooling air as possible through the front inlets of the cowl. Generally, this outlet should be about 2 1/2 times greater than the intake to allow hot air to escape. Following proper cooling practices will result in consistent engine performance in all weather conditions!



Modifications may be necessary when using a different engine. A saw is being used to cut the nose section for the muffler. This area was later prepared, sealed using balsa and epoxy finishing resin, and painted to match the fuselage color.



In a giant-scale gasser, use of thread-lock is mandatory wherever locknuts are not used.



To save time and effort, use paper templates whenever possible to ensure proper component sizing and positioning.



Using a paper template, I cut and drilled the throttle arm so that I could bolt it to the existing throttle arm, which didn't have the correct throttle linkage geometry for this particular application. The final assembly is secured using two 4-40 bolts and their respective locknuts.

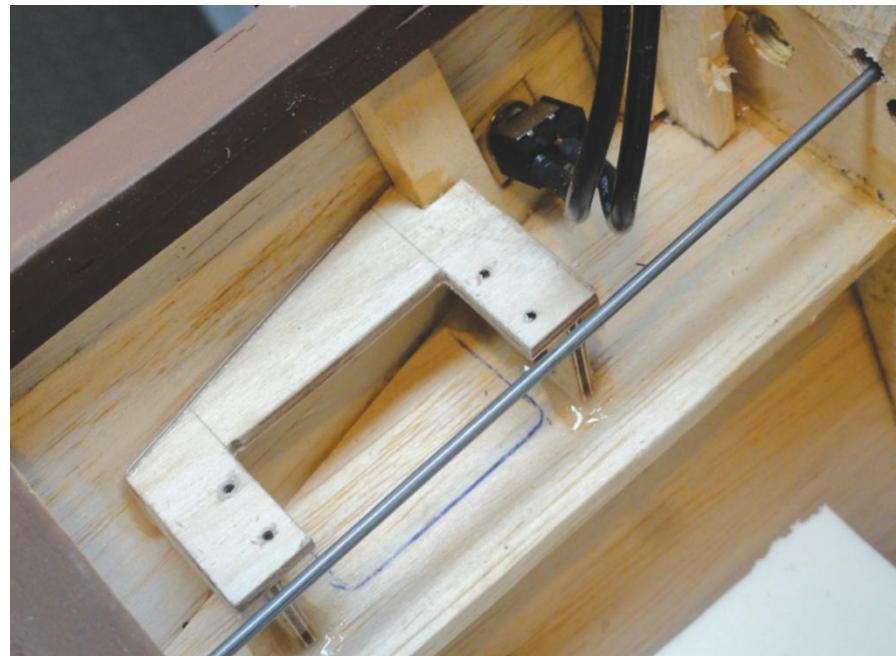
Many carburetors need an adapter for the existing arm that's secured to the carburetor, but this often does not allow proper servo travel. Zenoah Easy Link Carburetor Adapter is a plastic arm with a metal insert that has a setscrew that secures the arm to the carburetor. If you go this route, a number of manufacturers also offer various CNC throttle and choke arms for Walbro carburetors. I opted, however, to make my own arm out of the spare engine-mount material that was supplied with the engine to ensure that I obtained the proper distance and range of travel. Additionally, I prefer my adapter to secure to two different positions on the original arm using 4-40 bolts and locknuts.

As I did earlier with the engine-mount template, I cut a small piece

of paper and marked the holes in the carburetor arm by rubbing a pencil over each of them. It was then time to study the full range of travel for the carburetor arm and determine the proper location for the linkage attachment point. In my case, I measured the servo arm used from the servo screw to the ball-link attachment point and ensured that it matched that of the carburetor. I cut out the template, temporarily adhered it to the carburetor arm, and verified that the geometry would work. If modifications are required, do them now so that you only have to make one metal adapter. Use of a Dremel, drill press, and sanding files will prove beneficial. I attached a Du-Bro 4-40 ball-link and all required hardware onto my carburetor arm. I could now use a threaded pushrod to determine the proper hole that would be required in the firewall for the throttle pushrod and also determine the proper mounting position of the servo as the G-38 throttle servo would be mounted on the opposite side compared to that of the G-26. I could have installed two bellcranks to maintain the original throttle servo position, but I prefer simplicity.

Using a ruler held against the firewall and directly over the carburetor adapter ball-link location, I marked the firewall and drilled a 1/4-inch hole. After I threaded a 4-40 pushrod through the hole and onto the ball-link on the carburetor, I tested the full range of travel for the throttle butterfly. After verifying that it was correctly positioned, it was time to secure the throttle servo.

I made a U-shaped servo tray out of 1/8-inch aircraft plywood for a Spektrum S6260 servo and made two templates out of cardstock for a front and rear support that would secure the bottom and side of the tray to the fuselage. Because the fuselage side is contoured, I used templates until I created the proper shape. I then transferred the templates to aircraft plywood and cut out the pieces using a scroll saw. I glued perpendicular 1/4-inch spruce reinforcements where each support contacts the tray and then glued the



The throttle-servo tray was fabricated using aircraft-grade plywood, and secured in place using 30-minute epoxy and milled fiber.

entire assembly to the airframe with 30-minute epoxy and milled fiber from Bob Violet Models. I, of course, also installed grommets and eyelets on the servo to absorb the vibration produced by the engine, and I secured the servo-arm bolt to the servo with thread-lock.

Because I used a ball-link to attach the pushrod to the carburetor, I used a Du-Bro solder link to connect the pushrod to the servo. After powering up the engine, I maximized the travel for the throttle servo and then moved the throttle stick to 50% and opened the throttle butterfly the same amount. I then installed the solder link on the servo arm, and using a permanent marker, I marked the throttle pushrod where the solder link began. After powering off the engine, I cut the throttle pushrod so that it protruded from the solder link by about 1/16 inch. Using 220-grit

sandpaper, I roughed up the area where the clevis would contact the pushrod, cleaned the area, and applied flux on both the pushrod and the clevis. I then inserted the clevis, applied heat to the pushrod, and slowly allowed solder to wick into the clevis and secure it to the pushrod.

For safety, I decided to install a Zenoah kill switch to the left fuselage side under the leading edge of the wing for access. This two-position switch allows me to shut off the engine to prevent it from sparking in one position and then start the engine in the second position. Two wires come out of the switch, one of which will be grounded to the engine under an engine-mounting bolt or similar. The second wire, which comes from the factory with a male connector, must be cut and soldered to the wire on the front of the engine in front of the magneto coil. Closing the

switch grounds the coil and stops the engine.

FINAL THOUGHTS

In closing, this column shows the importance behind proper engine selection and installation practices. In the case of the Handley Page Type E, we installed a larger engine to allow for spare power if the need exists and to fly in higher winds with high heat and humidity. As always, use this column as a guide to improve your understanding of the best setup practices and, most important, enjoy every part of this great hobby and seek out every learning experience possible. 



The Spektrum S6260 servo has been installed, and the linkage has been finalized.



The G-38 has been installed, and the Handley Page Type E is ready for another flight!

Product Watch

MINI REVIEWS OF EDITORS' FAVORITES



Futaba 6L Sport

When you just want to fly a basic RC sport flier, sometimes less is more. Ideal for almost any RC model airplane, this 6-channel, 2.4GHz system has everything you need. The T-FHSS Mono Directional Air system comes with an R3106GF high-voltage receiver with fail-safe and has a full-range transmitter antenna built into its handle. There are no complicated program menus to navigate, and servo-reversing switches (for all six channels) are under the battery-compartment lid. Two additional switches are used to control V-tail, elevon, and flaperon mixing functions. The radio also has four analog trim levers. Also included are a low-battery voltage alarm, a buddy box (student connection), and a range check. There is no dual rate or expo. The instructions show how to set up the transmitter for either mode 1 or mode 2 control. If you are looking for a simple sport radio system and don't want to break the bank, the new 6L Sport from Futaba is a great choice. Priced at \$89.99, the 6L Sport gives you a quality-built Futaba radio system with solid radio performance.

—Gerry Yarrish
futabarc.com



Stepcraft Tool Length Sensor

When you start working with a 3-axis CNC system, you'll quickly learn the importance of the X, Y, and Z placement of your cutting tool. It's pretty straightforward to establish your start point on the X and Y axes, but the Z axis (the tool length position) is a different story. In a nutshell, you have to tell your CNC how thick your material is so that you can set the proper cut depth. Enter the Tool Length Sensor, which is, basically, a limit switch that is easy to wire into any Stepcraft desktop CNC system. Installation instructions and the downloadable program to control it are at stepcraft.us.

To use the Tool Length Sensor, you first clamp your job material in place, then put the sensor on top of the material. Load your tool path

file into the CNC drive program, bring your tool bit to the start position, and place the sensor under the tool bit. Now go to the CNC program dashboard and click the Tool Sensor icon button. The Z-axis spindle bracket will lower the tool until it touches the center contact button, when it will retract upward slightly and then slowly lower itself again to precisely depress the button once more. It will then retract to the starting position, and the CNC system will wait for you to run your job. Now just start the tool spindle and press the Go button to run your tool path file. Priced at \$119.00, the Stepcraft Tool Length Sensor will pay for itself by saving you precious setup time.—Gerry Yarrish
stepcraft.us

Xtreme Power Systems X24 Integrated Flight Control System

The X24 acts as a channel expander, power expander, voltage monitor, and fail-safe system for receivers that output a serial data stream. It's compatible with XtremeLink protocols as well as Futaba S.Bus and S.Bus2, Spektrum Satellite, JR DMSS S.Bus, Graupner HoTT SUMD, Jeti UDI, and Multiplex SLRx receivers. Up to four serial receivers can be used at once, and there are four separate Spektrum connectors that provide the necessary 3.3V support.

The X24 has up to 24 servo outputs, each individually assignable to any receiver channel and programmable for center and endpoints. The X24 Deluxe adds AutoMatch (automatic current matching for multiservo flight surfaces), which makes setting up these complex control arrangements push-button simple. AutoMatch can match up to 12 sets of master/slave servos.

OTHER FEATURES INCLUDE:

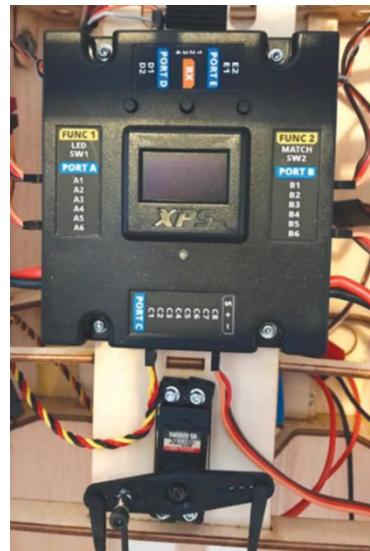
- Operating voltage from 2.1 to 16 volts
- Dual power input leads handle up to 100A each
- Bright OLED display shows operating conditions, voltage monitor, and programming
- Easily programmable via three push buttons on the unit or via PC connected by the optional XPS USB Serial Link
- 16 programmable sequencers built in
- Dual programmable BECs provide 5 or 6 volts up to 3 amps to power ignition modules, LEDs, or other accessories
- Programmable voltage monitor displays instantaneous voltage as well as highest and lowest voltages seen by the system
- Programmable fail-safe settings for each channel
- Optional electronic switch
- Firmware upgrades via the USB Serial Link



Above: The X24 Integrated Flight Control System combines the capabilities of a channel expander, power expander, voltage monitor, and BEC into one easy-to-program package. **Right:** A simple X24 installation in a Legacy

Aviation Turbo Bushmaster: aileron and flaps in ports A and B, rudder and elevator in port C, and speed control in port D.

The X24 is a very capable device, suitable for use in a wide variety of models. The AutoMatch feature makes big 3D aerobats with lots of servos easier to set up, eliminating the effects of poor geometry and mismatched servos. The programmable sequencers it provides make the X24 perfect for warbirds with gear doors, bomb-bay doors, and movable canopies to set up. The introductory price is \$199.95.—John Kauk xtremepowersystems.net



Slimline Products Flightline Fueler

Specifically designed to safely fuel and defuel RC airplanes, these new containers have a generous 3-gallon capacity and are molded out of rugged 3/16-inch-thick plastic. Compatible with gas, glow, and smoke oil, each has a wide 9 x 12-inch ribbed footprint, which makes the container practically impossible to tip over. The large molded handle grip makes carrying the fueler to and from your vehicle a piece of cake—and you can even use it for support when you're getting up from fueling your aircraft on the ground!

The containers come with a composite manual fuel pump and vented bung attached to keep debris from getting into your fuel, while the large-diameter top cap makes filling them quick and easy. Priced at \$89.99, each fueler also comes with a Tygon gas fuel line, an O-ring sealed universal fill nozzle, and CNC-machined hardware with an anodized finish. For easy identification, they are available in blue for glow fuel, red for gas, and white for smoke oil.

If you take your RC flying seriously and hate constantly refilling those small gas-station containers, give Slimline Products Flightline Fuelers a look. They're rugged and made to last.—Gerry Yarrish slimlineproducts.com +



FINAL APPROACH

TEXT & PHOTOS BY SAL CALVAGNA



Giant-Scale Morane Saulnier Type N

This French fighter has wing warping and an all-flying stabilizer



Brian Dean of East Hampton, New York, is a member of the Long Island Skyhawks and an accomplished giant-scale modeler. His latest build, a 1/3-scale Morane Saulnier Type N, is the culmination of his modeling experience to date. The full-size Type N entered service in April 1915, and only 49 were ever built. The aircraft's service life was short, and it was quickly rendered obsolete as more advanced aircraft developed.

To create his unique model, Brian found an old set of Nick Ziroli's Morane Saulnier Type N plans and enlarged and modified them to include the functional wing warping and all-flying stabilizer that the original full-size aircraft had. To do this, he also had to redraw the wing profile and replace the flat-bottom sport airfoil with thin undercambered ribs to keep the wing flexible. He copied the full-size aircraft's wing-warping mechanism, with the control cables riding through pulleys above the

wings and a servo-operated arm beneath to pull the trailing edge of the wing panels up and down. The system works extremely well as the model's roll rate is equivalent to having ailerons.

Brian created the model using the tried-and-true stick-build method, and he handmade all of its parts. The 107-inch-span plane is 64 inches long and weighs 24 pounds. The Morane is covered with natural Solartex and painted using several paint types, including gloss black spray paint, Nelson acrylic hobby paints, and some Floquil paints. He applied equal parts Minwax rub-on clear polyurethane satin with some brown Briwax brushed on and rubbed out. The N is powered by a 3W 55EI gas engine equipped with a K&S canister muffler. The model is finished in the colors of France's great ace: Jean Marie Navarre.

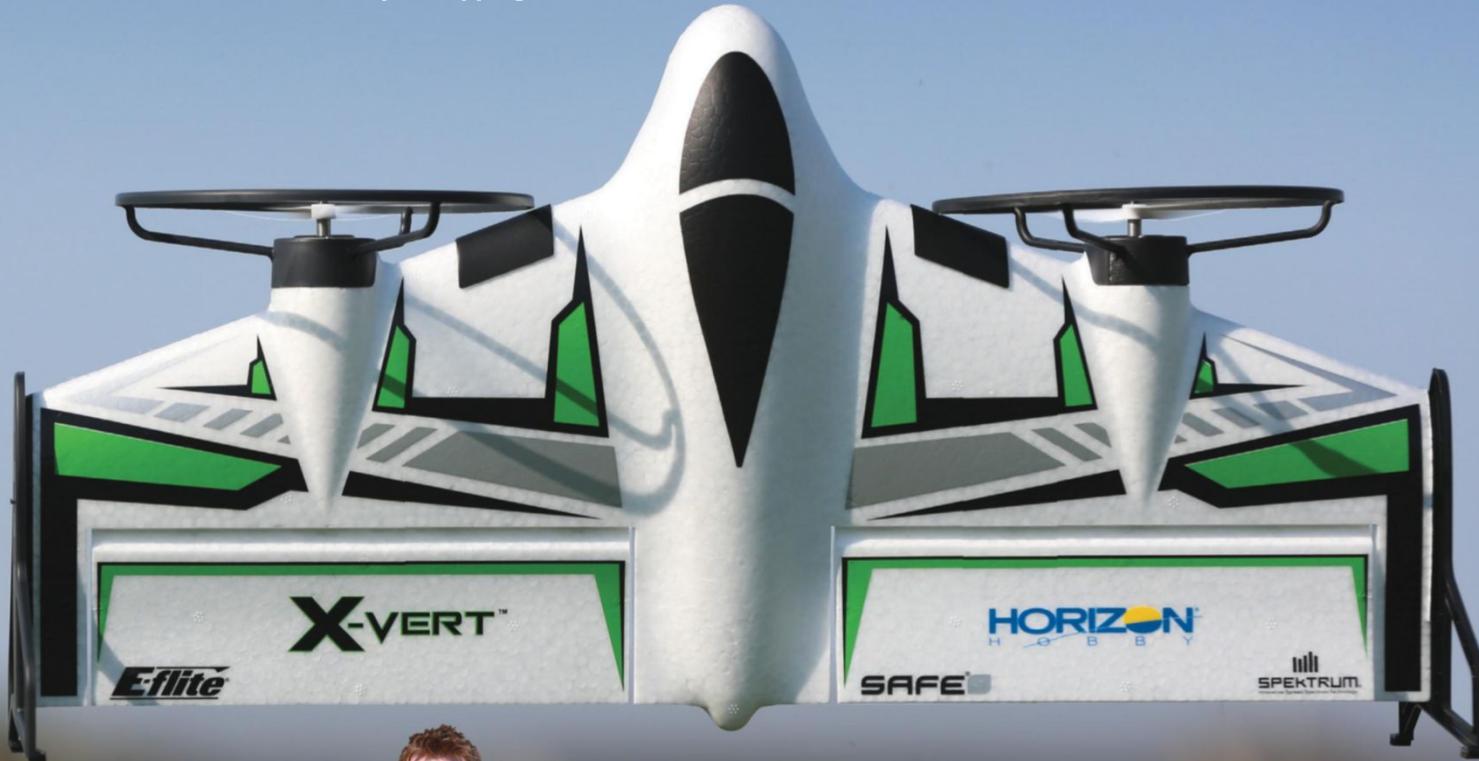
The model performs extremely well. Hats off to Brian for his amazing wing-warping project. +



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